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A National Historic Landmark Theme Study

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(Front Cover Photograph)
200-inch Hale Telescope and Dome

Russell W. Porter Drawing

Photo Credit:

Palomar Observatory

ASTRONOMY AND ASTROPHYSICS NATIONAL HISTORIC LANDMARK THEME STUDY

BY

DR. HARRY A. BUTOWSKY

NATIONAL PARK SERVICE

HISTORY DIVISION


MAY 1989

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May 1989



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TO THE MEMORY OF
EDWARD BUTOWSKY
1903-1988

ASTRONOMY AND ASTROPHYSICS NATIONAL HISTORIC LANDMARK THEME STUDY

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ASTRONOMY AND ASTROPHYSICS

NATIONAL HISTORIC LANDMARK THEME STUDY

INTRODUCTION

The Astronomy and Astrophysics National Historic Landmark Theme Study was prepared by the National Park Service for the National Park System Advisory Board as part of the National Historic Landmarks Program. The purpose of the study is to identify the sites, structures, buildings and objects significant in the history of the sciences of astronomy and astrophysics in the United States. Those properties nominated for National Historic Landmark designation in this study will be evaluated by the National Park System Advisory Board, a committee of scholars and other citizens. The Board will then recommend to the Secretary of the Interior the properties, which in its opinion, should be designated as National Historic Landmarks. The decision to designate or not designate a recommended property rests with the Secretary. A complete explanation of the purpose of the National Historic Landmarks Program and regulations of the program can be found in the appendix to this study.

The subject of astronomy was first covered by the National Park Service as part of Volume XX of the National Survey of Historic Sites and Buildings report, The Arts and Sciences: Scientific Discoveries and Inventions, 1964. The sites related to the history of the science of astronomy that were examined for designation under this theme were:

1. Lowell Observatory, Arizona
2. Meteor Crater, Arizona
3. California Institute of Technology, California
4. International Latitude Observatory, Ukiah, California
5. Lick Observatory, California
6. Mount Wilson Observatory, California
7. Old Naval Observatory, District of Columbia
8. Harvard College Observatory, Massachusetts
9. Maria Mitchell Observatory, Nantucket, Massachusetts
10. Nathaniel Bowditch House, Massachusetts
11. David Rittenhouse Birthplace, Pennsylvania
12. Matthew Fontaine Maury House, Virginia

At the 51st meeting of the Advisory Board on National Parks, Historic Sites, Buildings and Monuments in 1964, the following sites were recommended for designation as National Historic Landmarks.

1. Old Naval Observatory, District of Columbia (to recognize Matthew Fontaine Maury)
2. Nathaniel Bowditch House, Massachusetts (Navigation)

The board recommended that all action on the following observatories and on other sites related to the development of astronomy be deferred until a thorough study of the subject was made.

1. Lowell Observatory, Arizona
2. Lick Observatory, California
3. Mount Wilson Observatory, California
4. Harvard College Observatory, Massachusetts
5. Maria Mitchell Observatory, Massachusetts

Consideration of all the other sites discussed in the theme study was also deferred.

At the 53rd meeting of the Advisory Board on National Parks, Historic Sites, Buildings and Monuments in 1965, the Lowell Observatory was reconsidered and recommended for designation as a National Historic Landmark.

In 1975 the National Park Service, as part of a revision of the Science and Invention Theme Study, recommended the designation of the Edwin Hubble House in California as a National Historic Landmark. The Hubble House was designated in 1976.

In 1987 the National Park Service began a comprehensive study of observatories and other sites significant in the development of the history of astronomy in the United States. This study was soon expanded to include the related science of astrophysics. At that time only two properties, the Lowell Observatory and the Edwin P. Hubble House, were listed in the National Park Service publication, History and Prehistory in the National Park System and the National Historic Landmarks Program as landmarks significant in the science of astronomy.

In reviewing for this theme study I consulted Vol. XX of the National Survey of Historic Sites and Buildings Survey report, The Arts and Sciences: Scientific Discoveries and Inventions, 1964, and the general files and records of the National Historic Landmarks program. In addition, I reviewed properties listed in the National Register of Historic Places. These sources yielded the following properties for consideration under this theme.

1. Old Observatory, Alabama
2. Harquahala Peak Observatory, Arizona
3. Hale Solar Laboratory, California
4. Chamberlain Observatory, Colorado
5. Georgetown University Astronomical Observatory, District of Columbia
6. Old Naval Observatory, District of Columbia
7. University of Illinois Astronomical Observatory, Illinois
8. Earlham College Observatory, Indiana
9. McKim Observatory, Indiana
10. Portland Observatory, Maine
11. Gaithersburg Latitude Observatory, Maryland
12. Blue Hill Meteorological Observatory, Massachusetts
13. Harvard College Observatory, Massachusetts

14. Detroit Observatory, Michigan
15. Goodsell Observatory (New Observatory), Minnesota
16. Barnard Observatory, Mississippi
17. Weston Observatory, New Hampshire
18. Cincinnati Observatory, Ohio
19. Ohio Wesleyan University Student Observatory, Ohio
20. Allegheny Observatory, Pennsylvania
21. Stellafane Observatory, Vermont
22. Reber Radio Telescope, West Virginia
23. Buckstaff Observatory, Wisconsin
24. Washburn Observatory, Wisconsin

Additional sites, including the new Naval Observatory in Washington, DC, the Palomar Observatory in California, Yerkes Observatory in Wisconsin, the Dearborn Observatory in Illinois, and the Horn Antenna in New Jersey, were suggested by historians of astronomy and included on my initial study list. Further reading in the field of astronomy resulted in the inclusion of many additional sites, such as the Leander McCormick Observatory in Virginia, the McDonald Observatory in Texas, Sacramento Peak Observatory in California and the Kitt Peak Observatory in Arizona. In all, more than 100 sites, including laboratories, workshops, homes and sites associated with the lives and achievements of famous American astronomers, were included on my additional study list.

The subject of Prehistoric American Indian Astronomy (Archaeoastronomy) was not included within the framework of this theme study. The sites and issues involved in this discipline require the skills of a trained archeologist/anthropologist with a knowledge of astronomy and should be studied as a separate theme study.

In order to be recommended for designation as a National Historic Landmark a potential site must possess national significance in the history of the development of the sciences of astronomy or astrophysics in the United States. This significance can be demonstrated by the association of the property with some important event in the history of astronomy or through its association with the life of an important individual who has made a significant contribution to the science of astronomy. A full listing of these criteria can be found in the regulations of the National Historic Landmarks Program (36 CFR 65) in the appendix to this report.

From the initial study list of more than 100 properties, a total of 25 were actually visited. Of this total, 16 properties are recommended for designation as National Historic Landmarks. One site, the Blue Hill Meteorological Observatory, was included to represent the science of meteorology. No other sites representing the science of meteorology were studied.

Many of the properties not recommended for landmark designation are now listed in the National Register of Historic Places or are believed to be eligible for listing in the National Register of Historic Places. Other sites were not recommended for designation for a variety of reasons that are discussed in the sections at the end of this theme study. A short summary of those sites recommended for designation under this theme follows on the next page. A complete listing of all other properties examined but not recommended for designation can be found at the end of this study.

NATIONAL HISTORIC LANDMARK THEME STUDY ON ASTRONOMY AND ASTROPHYSICS

SUMMARY OF NOMINATIONS

CALIFORNIA

HALE SOLAR LABORATORY PASADENA

The Hale Solar Laboratory is important because of its association with its owner-builder, George Ellery Hale. Hale was an internationally famous scientist, a trustee behind the endowment of the Huntington Library and Art Gallery in San Marino, California, and a trustee and organizer of the California Institute of Technology.

The Hale Solar Laboratory was Hale's office and workshop for the later years of his life. Hale's scientific contributions were many, especially in the area of astronomy. Hale was one of the first scientists to compare observations in physics laboratories here on earth to what is seen in the heavens. He, more than anyone else, was the person most responsible for the rise of the science of modern astrophysics in the United States.

The Hale Solar Laboratory was also the site of many scientific discoveries, the most famous being Hale's refinement of the spectroheliograph, a device that made it possible to observe the hydrogen-rich prominences of the sun.

LICK OBSERVATORY BUILDING MOUNT HAMILTON

The 36-inch Clark refractor housed in the Lick Observatory building was the first large telescope erected on a site chosen for its astronomical advantages, rather than for convenience in the builder's backyard, or on a university campus. The location of the telescope on Mount Hamilton proved to be an excellent choice and provided an example that has been followed from 1888 until the present day. The discoveries of early Lick astronomers began a tradition of excellence at Lick that has had a profound impact in shaping the history of American astronomy in the twentieth century. By combining excellent equipment, a favorable location, and the proximity to the resources of the University of California, Lick established the pattern for large modern observatories that has continued to this day and has left a major imprint on modern astronomy.

LICK CROSSLEY 36-INCH REFLECTOR MOUNT HAMILTON

The Crossley 36-inch reflector at the Lick Observatory was the first of a long line of metal-film-on-glass modern reflecting telescopes that have dominated major astronomical advances for the past century. In addition, the Crossley has produced more scientific results than any other telescope of its size including several historically important studies in stellar evolution, the structure and spectra of planetary nebulae, and the discovery and spectral analysis of faint variable stars in young clusters. The Crossley also contributed to studies that confirmed the expansion of the universe.

MOUNT WILSON OBSERVATORY
PASADENA

The establishment of Mount Wilson Observatory in 1904, by American astronomer George Ellery Hale, brought a new era to the science of astronomy. The Snow horizontal telescope and the two solar tower telescopes were the first major instruments placed on Mount Wilson. Completion of the 60-inch reflector in 1908 and the 100-inch Hooker reflector in 1917 made Mount Wilson the home of the two largest telescopes in existence and the center of the astronomical world. These telescopes represented a quantum leap in mechanical and optical engineering capability. They laid the technological foundation for all large modern telescopes. Many of the major advances and greatest names in 20th-century astronomy are associated with the Mount Wilson Observatory, including Edwin P. Hubble, who in 1929 used the 100-inch Hooker reflector to gather data that showed the universe to be in a regular state of expansion, thereby providing the first clues to the origin of the universe.

PALOMAR OBSERVATORY 200-INCH REFLECTOR
SAN DIEGO COUNTY

The construction and delivery of the Pyrex glass disk for the Palomar 200-inch reflector in 1936 marked a watershed in the history of astronomy. With the successful casting of this large mirror, the Palomar project, conceived by George Ellery Hale (1868-1938), and funded with a grant of \$6 million by the Rockefeller Foundation, moved toward the completion of the largest reflecting telescope in the world by 1948. In the 40 years since the completion of the Palomar project, the 200-inch reflector remains at the leading edge of research in the sciences of astronomy and astrophysics and stands today as a monument to George Ellery Hale and his efforts to produce the finest instruments in the world to answer the fundamental questions concerning the origin and nature of the universe.

PALOMAR 48-INCH OSCHIN (SCHMIDT) TELESCOPE
SAN DIEGO COUNTY

Although not as well known as the 200-inch Hale reflector, the 48-inch Oschin (Schmidt) telescope at the Palomar Observatory has performed invaluable scientific research and has prepared the way for many of the important discoveries made by the 200-inch. This instrument was first used in 1950 to carry out two surveys of the Northern Hemisphere, one through a red filter and one through a blue, so that a comparison of the two black and white prints would reveal how cool (red) or how hot (blue) a star was. The surveys involved taking 1758 plates of the northern sky and recorded stars never seen before. The Palomar sky survey is the standard reference atlas for deep sky observation and provides a base line with which to measure changes in deep sky observation targets in future surveys. It is used as a standard reference tool for all modern observatories doing deep sky observation.

DISTRICT OF COLUMBIA

UNITED STATES NAVAL OBSERVATORY WASHINGTON, DC

The United States Naval Observatory is the oldest scientific institution in the Navy, being first established in 1830 as the Depot of Charts and Instruments. The observatory is most noted for its work in study of positional astronomy and timekeeping. The Naval Observatory, along with the Royal Observatory in Greenwich, England, and the Pulkovo Observatory in the Soviet Union, is one of the few places in the world that continually observes and redefines the positions of the sun, moon, planets, and stars. The United States Naval Observatory is the only place in the United States where precise instruments measure celestial motions to provide accurate time and other astronomical data which are essential for safe navigation at sea, in the air, and in space.

ILLINOIS

UNIVERSITY OF ILLINOIS OBSERVATORY URBANA

The University of Illinois Observatory is significant because of its association with the development of the selenium photoelectric cell which revolutionized the science of astronomical photoelectric photometry--the measurement of celestial magnitudes. The research was conducted on the 12-inch Warner and Swasey refractor telescope located in the second-story equatorial room of the 1896 brick observatory. The development of the selenium cell was done by Joel Stebbins (1878-1966), in the years from 1907 to 1922, while he was the director of the University of Illinois Observatory. As a result of Stebbins work at Illinois with the photoelectric cell, photoelectric photometry became the standard technique in determining stellar magnitudes. The determination of stellar magnitudes is one of the most fundamental measurements in the field of astronomy.

MASSACHUSETTS

BLUE HILL METEOROLOGICAL OBSERVATORY EAST MILTON

The Blue Hill Meteorological Observatory is the foremost structure associated with the history of weather observations in the United States. Founded by Abbott Lawrence Rotch on February 1, 1885, the observatory took a leading role in the newly emerging science of meteorology and was the scene of many of the first scientific measurements of upper atmosphere weather conditions using kites to carry weather instruments aloft. Knowledge of wind velocities, air temperature and relative humidity at various levels came into use as vital elements in weather prediction due to techniques developed at this site. By 1895 the observatory was the source of weather forecasts of remarkable accuracy. The observatory remains active to this day, continuing to add to the data base of weather observations now over 100 years old, and stands as a monument to the science of meteorology in the United States.

MARYLAND

GAITHERSBURG LATITUDE OBSERVATORY GAITHERSBURG

The Gaithersburg Latitude Observatory is significant for its association with the study of polar motion, and for its symbolic value in representing an important and long-lived program of international scientific cooperation. Established in 1899 by the International Geodetic Association, the International Polar Motion Service was a cooperative effort among scientists worldwide to study the Earth's wobble on its rotational axis. The Gaithersburg Latitude Observatory was one of six observatories around the world (in the United States, Russia, Japan, and Italy) commissioned under this program.

Between 1900 and 1960 these observatories were the best source of information on polar motion available to scientists. Data supplied by the six latitude observatories have been used in hundreds of scientific papers and studies investigating the geophysics of the earth. The observatories have enabled geodesists to better understand the size and shape of the earth and astronomers to adjust their observations for the effects of polar motion. In more practical terms, the work done by the observatories contributed to studies attempting to determine earthquake mechanisms and the elasticity of the earth, and to predict climate variations. The space program has also benefited from this work; polar motion study is necessary to determine orbit patterns of spacecraft and satellites, and aids tracking techniques used in deep space navigation.

The latitude observatories made a major contribution to science on an international scale. The research undertaken in these small, simple structures fueled work done in earth motion studies for decades. From its construction in 1899 until the obsolescence of man-operated telescopic observation forced its closing in 1982, the Gaithersburg Latitude Observatory played an integral role in this important scientific endeavor.

NEW JERSEY

HORN ANTENNA HOLMDEL

The Horn Antenna, at the Bell Telephone Laboratories in Holmdel, New Jersey, is significant because of its association with the research work of two radio astronomers, Dr. Arno A. Penzias and Dr. Robert A. Wilson. In 1965 while using the Horn Antenna, Penzias and Wilson stumbled on the microwave background radiation that permeates the universe. Cosmologists quickly realized that Penzias and Wilson had made the most important discovery in modern astronomy since Edwin Hubble demonstrated in the 1920s that the universe was expanding. This discovery provided the evidence that confirmed George Gamow's and Abbe Georges Lemaitre's "Big Bang" theory of the creation of the universe and forever changed the science of cosmology--the study of the history of the universe--from a field for unlimited theoretical speculation into a subject disciplined by direct observation. In 1978 Penzias and Wilson received the Nobel Prize for Physics for their momentous discovery.

OHIO

CINCINNATI OBSERVATORY

CINCINNATI

The Cincinnati Observatory is one of the oldest functioning observatories in the United States. Founded in 1843, it was located on Mount Adams until 1873, when it was moved to its present site on Mount Lookout, just off Observatory Avenue, in Cincinnati. The present observatory building dates from 1873.

The Cincinnati Observatory was the first fully equipped observatory in the midwest and is associated with the productive careers of such famous American astronomers as Ormsby MacKnight Mitchel (1809-1862), who published the Sidereal Messenger, the first attempt to bring astronomy to the masses in the United States, and Paul Herget (1908-1981), who was the world's foremost authority on the computation of planetary orbits. In addition, the Cincinnati Observatory is associated with Cleveland Abbe (1838-1916), a meteorologist who began to issue daily weather bulletins in 1869. Abbe's work proved so popular with the American public that steps were taken to establish a permanent government institution to continue this service--the United States Weather Bureau.

PENNSYLVANIA

ALLEGHENY OBSERVATORY

PITTSBURGH

The Allegheny Observatory at the University of Pittsburgh is significant because of its association with the careers of astronomers Samuel Pierpont Langley (1834-1906), James Edward Keeler (1857-1900), and telescope maker John Alfred Brashear (1840-1920).

Langley was professor of astronomy and physics at the University from 1867 to 1887 and director of the Allegheny Observatory. During that time he invented the bolometer and used it in 1878 to make spectral observations of solar and lunar radiation. His paper on The Bolometer and Radiant Energy (1881) became a scientific classic. While Langley was the director, the Allegheny Observatory was the leading American observatory on matters relating to the study of solar physics.

James Edward Keeler succeeded Langley as director of the Allegheny Observatory and used the 13-inch Fitz-Clark refractor with a spectroscope to show, in 1895, that the rings of Saturn were rotating as a unit but that the inner boundary had a considerably shorter period than the outer. This was the first observational evidence that the rings were not solid but consisted of discrete particles circling the planet at different speeds.

John Alfred Brashear was named acting director of the Allegheny Observatory after Keeler's departure for the Lick Observatory in 1898. Brashear was a self-taught optician whose service to astronomy began in 1876 when he began to make astronomical telescopes. Over the years of his active career Brashear not only made both of the larger telescopes used at the Allegheny Observatory, but came to be recognized as one of the best telescope makers of his day. In the years since Brashear's death in 1920, the Allegheny Observatory has used

his telescope (the Thaw refractor) to do fundamental work in the field of astrometry, including the search for stars whose oscillations betray the presence of invisible companions.

VERMONT

STELLAFANE OBSERVATORY SPRINGFIELD

The Stellafane Observatory in Springfield, Vermont, possesses national significance for its pioneering role in the development of amateur telescope making and popular astronomy in the United States. The Stellafane complex contains both the original clubhouse of the first organized group of amateur telescope makers in the country, the Springfield Telescope Makers, Inc., and the first large optical telescope built and owned by that kind of amateur society. Since their construction in 1924 and 1930, respectively, the clubhouse and observatory have remained in continuous use by the Springfield Telescope Makers, and have been preserved essentially in original condition. Stellafane now holds an international reputation which attracts thousands of amateur telescope makers and astronomers to annual conventions held on the site.

WEST VIRGINIA

REBER RADIO TELESCOPE GREENBANK

The Reber Radio Telescope was the first parabolic antenna specifically designed and built to do research in the newly emerging field of radio astronomy. The telescope was designed and built by Grote Reber, an amateur astronomer and electronics expert from Wheaton, Illinois, who from 1937 until after World War II, was the world's only active radio astronomer. The telescope design is the forerunner of the majority of present day radio telescopes.

WISCONSIN

YERKES OBSERVATORY WILLIAMS BAY

Yerkes Observatory was founded by American astronomer George Ellery Hale in 1897 and represents his revolutionary concept for an observatory that would also be a physical laboratory. To the majority of astronomers at the time an observatory was simply a place for a telescope and observer. For example, when the new United States Naval Observatory in Washington, DC, was completed in 1893, there was no provision for a darkroom or for a spectroscopic laboratory. In contrast, Yerkes Observatory was provided with laboratories and a variety of mechanical and electrical workshops. Yerkes represented the wave of the future and established the modern observatory as a research institution where the astronomer, using the disciplines of chemistry and physics, supported by engineering and optics workshops, could apply his talents to the understanding of the wonders of the universe. In the years since its founding by George Ellery Hale, Yerkes has attracted the most famous astronomers in the world, and contributed significantly to the sciences of astronomy and astrophysics.

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 18). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name Hale Laboratory
other names/site number _____

2. Location

street & number 740 Holladay Road not for publication
city, town Pasadena vicinity
state California code CA county Los Angeles code 034 zip code 91106

3. Classification

Ownership of Property	Category of Property	Number of Resources within Property	
<input checked="" type="checkbox"/> private	<input checked="" type="checkbox"/> building(s)	Contributing	Noncontributing
<input type="checkbox"/> public-local	<input type="checkbox"/> district	<u>1</u>	<u>2</u> buildings
<input type="checkbox"/> public-State	<input type="checkbox"/> site	_____	_____ sites
<input type="checkbox"/> public-Federal	<input type="checkbox"/> structure	_____	_____ structures
	<input type="checkbox"/> object	_____	_____ objects
		<u>1</u>	<u>2</u> Total

Name of related multiple property listing: _____

Number of contributing resources previously listed in the National Register 1

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of certifying official

Date

State or Federal agency and bureau

In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of commenting or other official

Date

State or Federal agency and bureau

5. National Park Service Certification

I, hereby, certify that this property is:

entered in the National Register.
 See continuation sheet.

determined eligible for the National Register. See continuation sheet.

determined not eligible for the National Register.

removed from the National Register.

other, (explain:)

Signature of the Keeper

Date of Action

6. Function or Use

Historic Functions (enter categories from instructions)

Research Facility

Private Library

Current Functions (enter categories from instructions)

Private Library

7. Description

Architectural Classification

(enter categories from instructions)

Spanish Colonial Revival

Materials (enter categories from instructions)

foundation concrete

walls concrete

Mission tiles

roof

other

Describe present and historic physical appearance.

The Hale Solar Laboratory is a T-shaped reinforced concrete structure of Spanish Colonial Revival design with a chimney, mission tiles, rough plastered walls, and deep set windows. The building is set back on a rectangular lot on Holladay Road, behind a plastered wall, in Pasadena, California. ¹

Designed in 1924 by the architectural firm of Johnson, Kaufman, and Coate, of Pasadena, California, the Laboratory's dimensions are 21 feet x 49 feet with two sections: the observatory and telescope, and the library and living room. The third wing, which forms the "T" is below grade and contains dynamos, transformers, and the heating and ventilating plant. There are six rooms in all, built for \$14,000.

The portion of the building facing Holladay Road has two sections. The northern portion has a gabled, tiled roof, the gable end facing north. A chimney interrupts this roof line on the east. Two deep set plain windows pierce the roughly plastered wall. Each window has a smaller rectangular tile inset near the roof line. The second section facing Holladay Road is the telescope tower, 21 feet square with a domed top 14 feet in diameter and rising 30 feet from ground level. A long rectangular window similar to those in the adjacent portion of the building can be found with a blue tiled inset within a quatrefoil recess set closer to the roof line. The roof is flat with a parapet wall 2.5 feet high. In the center of the tower, descending from the spectrograph room in the basement, is a well 10 feet in diameter and 78.5 feet deep.

Facing to the south in the tower is the front door. This arched entrance is approximately 15 feet tall. Set into the upper portion of the arch are astronomical details including the sun and its rays. Because of Hale's interest in Egyptology, he commissioned the well known sculptor, Lee Lawrie, to create two bas-reliefs. The cast stone bas-relief over the doorway is a tribute to Akhnaton (the King of Egypt and worshipper of the sun god, Aton) symbolized by the sun's rays that end in the hands that grasp the symbol of life--a copy from a Theban tomb. Another bas-

 See continuation sheet

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 7 Page 2

relief by Lawrie is positioned over the fireplace in the library. Many scientific journals and books belonging to George Ellery Hale remain in the basement.

The sycamore trees flanking the entrance, the loquat trees, and the arbutus that surround the Hale Solar Laboratory were planted in 1928. The design for the landscaping was done by Beatrix Farrand, who also designed the grounds, the parking court with its dwarf myrtis hedge and sour citrus trees and the drive which centers on the dome.

The observatory is at the end of a long driveway which is lined with mature plants. The street facing facade is no longer visible, but the path leading to the entrance remains intact. The 1924 annual report from Mount Wilson describes the lot as 95 feet x 300 feet--the same lot size as today, suggesting the plantings and design could be original. There is an outbuilding at the northeast corner of the lot. The long asphalt central driveway terminates at a large open motor court just beyond the metal gates in the plastered masonry wall across the width of the property from north to south. The driveway is located on the east-west axis of the observatory portion of the building.

The exterior of the basement is surrounded by a light moat. Stairs with an iron railing lead from the northern facade to the moat, which surrounds all of the building except that portion which is part of the telescope tower. An arched window is in the northern facade. The east and west walls of the structure are mirror images, except for the chimney on the eastern wall.

The telescope tower has 45° clipped corners and the tower portion has overflows for roof drainage.

The Hale Solar Laboratory has not been altered since its construction in 1924. The building is in excellent condition and retains much of the original equipment and personal books and journals used by George Ellery Hale.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

nationally statewide locally

Applicable National Register Criteria A B C D NHL Criteria 1,2

Criteria Considerations (Exceptions) A B C D E F G

Areas of Significance (enter categories from instructions)
National Register: Science

Period of Significance
1924-1952

Significant Dates

National Historic Landmark: Science,
Subtheme: Physical Science, Facet:
Astronomy

Cultural Affiliation
N/A

Significant Person
George Ellery Hale

Architect/Builder
Johnson, Kaufman, Coate

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

Summary

The Hale Solar Laboratory is significant because of its association with its owner-builder, George Ellery Hale. Hale was an internationally famous scientist, a trustee behind the endowment of the Huntington Library and Art Gallery in San Marino, California, and a trustee and organizer of the California Institute of Technology.

The Hale Solar Laboratory was Hale's office and workshop for the later years of his life. Hale's scientific contributions were many, especially in the area of astronomy. Hale was one of the first scientists to compare observations in physics laboratories here on earth to what is seen in the heavens. He, more than anyone else, is the person most responsible for the rise of the science of modern astrophysics in the United States.

The Hale Solar Laboratory is also significant as the site of many scientific discoveries, the most famous being Hale's refinement of the spectroheliograph, a device that made it possible to observe the hydrogen-rich prominences of the sun.

See continuation sheet

United States Department of the Interior
National Park ServiceNational Register of Historic Places
Continuation SheetSection number 8 Page 2History

George Ellery Hale was born in Chicago, Illinois, on June 29, 1868. Hale graduated from the Massachusetts Institute of Technology in 1890 and after some work in Europe, organized the Kenwood Observatory in Chicago. There in 1889 he invented the spectroheliograph, a device that made it possible to photograph the light of a single spectral line of the sun. Thus he was able to photograph the sun by the light of glowing calcium, and the result was a clear indication of the distribution of calcium in the solar atmosphere. Hale detected calcium clouds in the Sun that he called flocculi.²

To continue his research Hale felt the need for larger and more sophisticated telescopes. This led to Hale's greatest accomplishments--organizing and carrying out projects involving the construction of astronomical observatories. During the course of his career, Hale was responsible for the founding of three major observatories: Yerkes in Wisconsin, and Mount Wilson and Palomar in California. He built the world's largest telescopes many times over.

Hale began work on his first large observatory in 1892 when he persuaded Chicago street-car magnate Charles Tyson Yerkes to support the establishment of a large astronomical observatory for the University of Chicago. Hale had Alvan G. Clark begin the process of grinding and polishing the glass disks for the proposed 40-inch refractor. Yerkes Observatory was completed in 1897, and its 40-inch refractor remains the largest refractor in the world today. Generations of astronomers have been trained or worked at Yerkes, in the past century making use of the fortunate combination of Yerkes' money and Hale's vision.

Hale was not satisfied and soon left Yerkes to travel to California in pursuit of newer and more powerful telescopes. In 1904 he founded the Mount Wilson Observatory, obtaining the funding from steel magnate Andrew Carnegie. A 60-inch reflecting telescope was placed in operation there in 1908 and a 100-inch reflecting telescope was placed in operation in 1917, the latter paid for by the Los Angeles hardware tycoon, John D. Hooker.³

The 100-inch was to remain the largest telescope in the world for a generation. By using this telescope, astronomers at Mount Wilson in 1930 first observed velocities of galaxies increase progressively with ever-increasing distances from the earth. This observation, combined with an earlier observation made on this telescope in 1924 that galaxies are stellar systems, clarified one of the most basic questions of cosmology--the nature of the large scale structure of the universe.⁴

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 8 Page 3

It was at the Mount Wilson Observatory in 1908 that George Ellery Hale made his most famous scientific discovery when he detected the existence of strong magnetic fields inside sunspots. This was the first association of magnetic fields with any extraterrestrial body.⁵

Hale's activities reached into many fields during this time. With colleagues Alfred Noyes and Robert Millikan, he transformed the Throop Polytechnic Institute into the California Institute of Technology. He persuaded Henry E. Huntington to endow the Huntington Library and Art Gallery. As a member of the Pasadena Planning Commission he was influential in obtaining for Pasadena the coordinated civic center buildings--City Hall, Civic Auditorium, and Central Library. For this work he received the Noble medal from the City of Pasadena, an award set aside for outstanding local citizens.

Some of his other contributions are less well known. He co-founded the International Astronomical Union (IAU) and the Astrophysical Journal. He persuaded President Woodrow Wilson to form the National Research Council, through which scientific minds could be best used to help the country during World War I. Hale worked with Bertram Goodhue on the plans of the building designed in 1924 for the Research Council in Washington, DC.

After retiring from the active directorship of the Mount Wilson Observatory in 1923 Hale searched for a site for a new observatory--one where he could work undisturbed. Hale investigated observing conditions around Pasadena and found that the "seeing" was actually better in the valley than on Mount Wilson during the middle part of the day. A 95 x 300 foot lot was purchased from the Henry E. Huntington Library and Art Gallery near the southern border of Pasadena.

Construction began in 1924. The building permit application, dated April 18, 1924, lists the architect as Johnson, Kaufman, & Coate, one of the more prominent firms in Pasadena. The reinforced concrete structure was built under the supervision of George Jones of the Mount Wilson Observatory staff. The 21 x 49 foot building included a dome housing equipment for viewing the sun (with a 78 foot pit below ground), a library, and a basement with shop and lab.

The project was financed largely by George Ellery Hale personally, although construction and some of the equipment were provided by Carnegie Institution. Upon completion in 1925 Hale made a gift of the buildings, grounds, and equipment to the Carnegie Institution of Washington. The Solar Lab was to become a permanent branch of the Mount Wilson Observatory.

**United States Department of the Interior
National Park Service****National Register of Historic Places
Continuation Sheet**Section number 8 Page 4

Hale spent his retirement years at his lab studying the sun with instruments of his design. He installed a spectroheliograph at the lab, a device to photograph the sun using the light of a single wavelength. Hale had won the Janssen Gold Medal of the Paris Academy of Science in 1894 for this invention. While at the lab, Hale redesigned the spectroheliograph, to allow the sun to be seen by hydrogen light. Hale's new instrument, called the spectroheliograph, showed up the prominences of the sun in greater detail than ever before observed. In his spare time he wrote several books, while also completing plans for the 200-inch telescope at Palomar Mountain.

After Hale's death in 1938 the Hale Solar Laboratory continued to be used as a solar observatory for many years. It was at the Hale Solar Laboratory in 1952 that Mount Wilson astronomers Harold and Horace Babcock (father and son) constructed the first solar magnetograph. This instrument finally enabled astronomers to measure the general magnetic field of the sun, a goal which had long been sought after by Hale. In 1985 the Hale Solar Laboratory was sold to William and Christine Shirley, who built a private residence on the grounds. The laboratory currently houses the offices of the Mount Wilson Institute, a non-profit organization, formed in 1986 to operate the Mount Wilson Observatory when the Carnegie Institution of Washington announced plans to withdraw from the Observatory.

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 8 Page 5

Footnotes

1. Most of the material in this form was adapted from the following sources.

Lorraine Melton, "National Register of Historic Places Inventory-Nomination Form-Hale Solar Laboratory." (Pasadena, California: Pasadena Heritage, 1984).

Christine Shirley, "The Hale Solar Laboratory-740 Holladay Road-Pasadena, California-A Guided Tour..." (Pasadena, California: Christine Shirley, 1985).

2. Isaac Asimov, Asimov's Biographical Encyclopedia of Science and Technology (New York: Doubleday & Company, Inc. 1982), pp. 622-623.
3. Ibid.
4. The American Society of Mechanical Engineers, "The 100-Inch Telescope of the Mount Wilson Observatory" (Northrop Corporation, 1981).
5. Asimov, op. cit., 622.

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 9 Page 2

Bibliography

Abell, George O. Exploration of the Universe. 4th ed., Philadelphia: Saunders College Publishing, 1982.

American Society of Mechanical Engineers. The 100-Inch Telescope of the Mount Wilson Observatory. Northrop Corporation, 1981.

Annual Report by Director of Mt. Wilson Observatory, 1924.

Annual Report by Director of Mt. Wilson Observatory, 1925.

Asimov, Isaac. Asimov's Biographical Encyclopedia of Science & Technology. New York: Doubleday & Company, 1982.

_____. Eyes On The Universe. Boston: Houghton Mifflin Company, 1975.

Learner, Richard. Astronomy Through the Telescope. New York: Van Nostrand Reinhold Company, 1981.

Melton, Lorraine. "National Register of Historic Places Inventory-Nomination Form-The Hale Solar Laboratory." Pasadena, California: Pasadena Heritage, 1984.

Pasadena Community Book, 1947. pp. 330-331.

Sanborn Fire Insurance Maps, and Building Permits, City of Pasadena Urban Conservation Department, City of Pasadena.

Shirley, Christine. The Hale Solar Laboratory-740 Holladay Road-Pasadena-A Guided Tour... Pasadena, California: Mrs. Christine Shirley, 1985.

Wright, Helen. Explorer of the Universe: A Biography of George Ellery Hale. New York: E. P. Dutton & Co., Inc., 1966.

9. Major Bibliographical References

See Continuation Sheet

Previous documentation on file (NPS):

- preliminary determination of individual listing (36 CFR 67) has been requested
- previously listed in the National Register
- previously determined eligible by the National Register
- designated a National Historic Landmark
- recorded by Historic American Buildings Survey # _____
- recorded by Historic American Engineering Record # _____

See continuation sheet

Primary location of additional data:

- State historic preservation office
- Other State agency
- Federal agency
- Local government
- University
- Other

Specify repository: _____

10. Geographical Data

Acres of property 0.672

UTM References

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3	9	6	6	7	0
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3	7	7	7	2	7	0
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Zone Easting Northing

B

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Zone Easting Northing

C

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D

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See continuation sheet

Verbal Boundary Description

Assessor map number 5327-7-39' commencing at the NE corner of Lombardy Rd. and Holladay Rd., go south 282.29', then east 313.43', turn 95' south, then go 300' west, and then north 95.34 to point of origin.

See continuation sheet

Boundary Justification

This is the original lot purchased by George Ellery Hale in 1923,

See continuation sheet

11. Form Prepared By

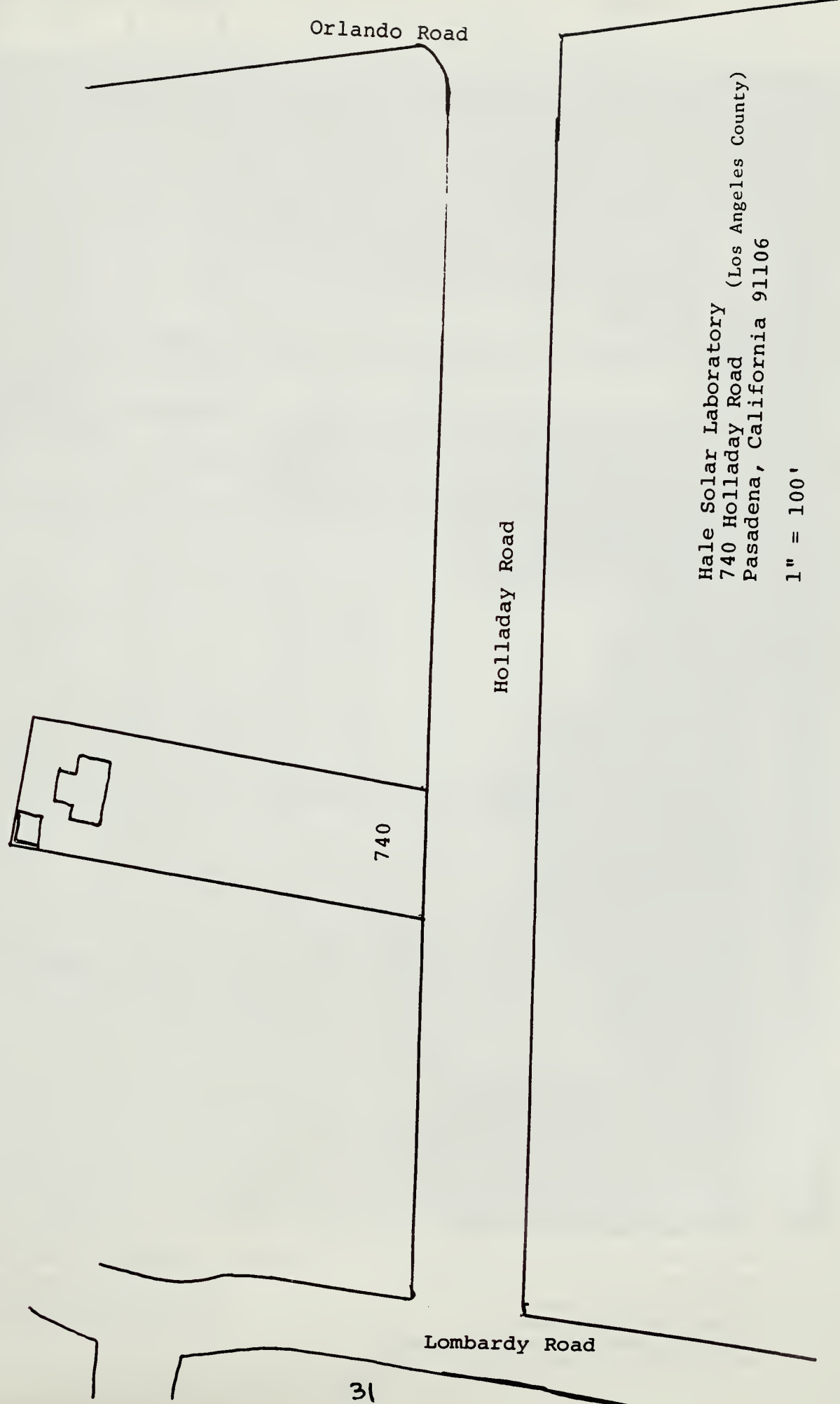
name/title Harry Butowsky

organization National Park Service date May 1, 1989

street & number 1100 L Street, N.W. telephone (202) 343-8155

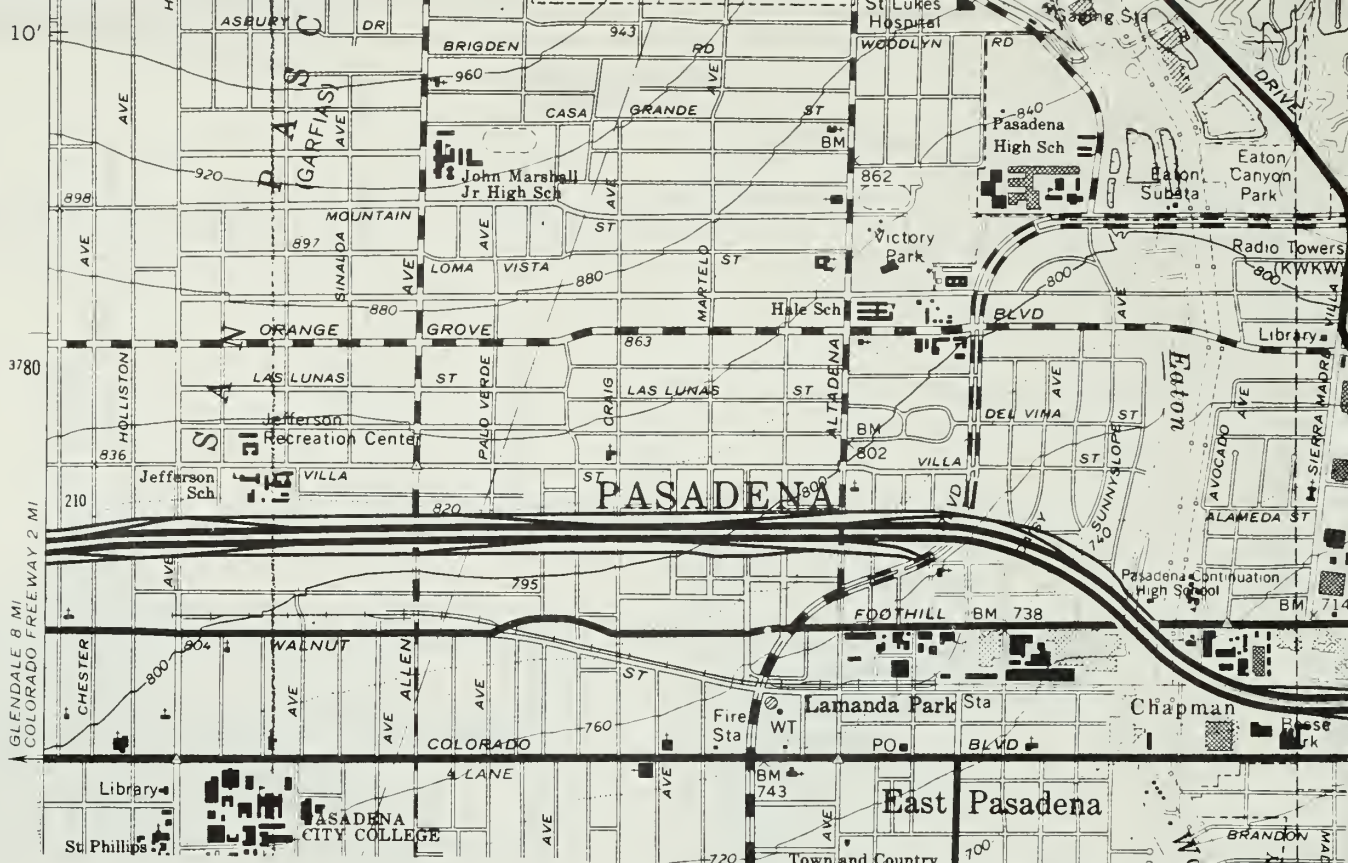
city or town Washington state DC zip code 20013

← North



Hale Solar Laboratory
740 Holladay Road (Los Angeles County)
Pasadena, California 91106

1" = 100'



HALE SOLAR LABORATORY
Mt. Wilson Quadrangle

11/396670/3777270



Mapped, edited, and published by the Geological Survey

Control by USGS, NOS/NOAA and Los Angeles Co

Topography by photogrammetric methods from aerial photographs taken 1964. Field checked 1966

Supersedes map surveyed 1924-34, revised 1953

Polyconic projection. 1927 North American Datum

10,000-foot grid based on California coordinate system, zone 7

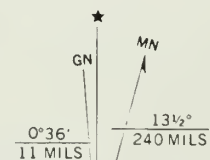
1000-meter Universal Transverse Mercator grid ticks, zone 11, shown in blue

Red tint indicates areas in which only landmark buildings are shown

Where omitted, land lines have not been established

Areas covered by dashed light-blue pattern are subject to controlled inundation

To place on the predicted North American Datum 1983 move the projection lines: 2 meters north and



UTM GRID AND 1988 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

Revisions shown in purple and woodland compiled from aerial photographs taken 1986 and other source data. Partial field check by U.S. Forest Service. Map edited 1988



Hale Solar Laboratory — Pasadena, California
Front View, 1931

Photo Credit: Mrs. Christine Shirley



Hale Solar Laboratory — Pasadena, California
Library, 1926

Photo Credit: Mrs. Christine Shirley



Hale Solar Laboratory — Pasadena, California
Basement Workshop, 1926

Photo Credit: Mrs. Christine Shirley



Hale Solar Laboratory — Pasadena, California
George Ellery Hale using the Spectroheliograph, 1926

Photo Credit: Mrs. Christine Shirley

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name Lick Observatory Building
other names/site number _____

2. Location

street & number Mount Hamilton not for publication
city, town Santa Clara County vicinity
state California code CA county Santa Clara code 085 zip code 95064

3. Classification

Ownership of Property	Category of Property	Number of Resources within Property	
<input type="checkbox"/> private	<input type="checkbox"/> building(s)	Contributing	Noncontributing
<input type="checkbox"/> public-local	<input checked="" type="checkbox"/> district	<u>1</u>	_____
<input checked="" type="checkbox"/> public-State	<input type="checkbox"/> site	_____	_____ buildings
<input type="checkbox"/> public-Federal	<input type="checkbox"/> structure	_____	_____ sites
	<input type="checkbox"/> object	_____	_____ structures
		<u>1</u>	_____ objects
			_____ Total

Name of related multiple property listing: _____
Number of contributing resources previously listed in the National Register _____

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of certifying official _____ Date _____

State or Federal agency and bureau _____

In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of commenting or other official _____ Date _____

State or Federal agency and bureau _____

5. National Park Service Certification

I, hereby, certify that this property is:

entered in the National Register.
 See continuation sheet.

determined eligible for the National Register. See continuation sheet.

determined not eligible for the National Register.

removed from the National Register.

other, (explain:) _____

Signature of the Keeper

Date of Action

6. Function or Use

Historic Functions (enter categories from instructions)

Education

Research Facility

Current Functions (enter categories from instructions)

Education

Research Facility

7. Description

Architectural Classification

(enter categories from instructions)

Italian Renaissance

Materials (enter categories from instructions)

foundation concretewalls brickroof iron dome

other _____

Describe present and historic physical appearance.

The Lick Observatory building is situated on the summit of Mount Hamilton, 4,029 feet high, in Santa Clara County, California. A narrow paved road leads to the mile-long ridge at the summit.¹

The construction of the Lick Observatory building began in January 1880 under the direction of Thomas Fraser, James Lick's agent, who had recommended to Lick the selection of the site, and Capt. Richard S. Floyd, who was responsible to the trustees of Lick's estate for the planning of the observatory buildings and the development of the instrumentation. Fraser insisted on a high standard of craftsmanship in the completion of the project.

To level the top of Mount Hamilton, Fraser had the top thirty feet of the mountain removed with black powder explosives. Workers then moved, by hand, an estimated 40 thousand tons of rock they had loosened. Masons built a kiln next to a clay bed near the summit and fired the bricks for the building. All of the heavy materials for the dome and telescope mounting were hauled up the mountain by wagon team and lifted into place with simple mechanical aids.

The Lick Observatory building was designed by architect S.E. Todd of Washington, DC, in the Italian Renaissance style with the use of deep entablatures and moldings, and a pediment over the west door. The building was completed in 1885 except for the large dome housing the 36-inch refractor. The observatory building has an entrance hall at the center with offices and workrooms opening off a corridor on either side. A small 25-foot dome is at the north end of the building, and a large 75-foot dome is at the south end of the building. The 25-foot dome originally held a 12-inch Clark refractor. This dome now houses a 40-inch reflector known as the Nickel telescope.

 See continuation sheet

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 7 Page 2

The large dome, housing the 36-inch refractor, was completed in 1887 by the Union Iron Works of San Francisco, and weighs 90 tons. The dome was advanced for its time in that its design compensated for metal expansion. The circular floor rises and descends through approximately 17 feet to follow the eyepiece of the 58-foot telescope tube. While electric motors now provide power, the original hydraulic cylinders still support and move the floor.

The 36-inch Clark refractor at the Lick Observatory was installed in 1888. In addition to the crown and flint elements of the achromat, there was a 33-inch correcting lens for photographic work. The 36-inch lens is mounted in a 58-foot riveted tube that is four feet in diameter at the center and surrounded by cranks, gears, rods, and chains to move the telescope.

The mounting for the 36-inch refractor was made by the Warner and Swasey Company. The telescope is set on a cast iron pier 10 x 17 feet at the base, tapering to 4 x 8 feet at the top. James Lick's body is buried in the base of the pier supporting the 36-inch refractor. A simple bronze plaque with the inscription "Here lies the body of James Lick" is mounted on the pier.

In 1985 the 36-inch objective lens was refinished. The walls of the observatory building are under repair to correct recent earthquake damage. The observatory building and 36-inch refractor are still intact and will be returned to full use in 1989.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

nationally statewide locally

Applicable National Register Criteria A B C D NHL Criteria 1

Criteria Considerations (Exceptions) A B C D E F G

Areas of Significance (enter categories from instructions)

Period of Significance

Significant Dates

National Register Significance
Education, Engineering, Science

1888-Present

1888-Present

National Historic Landmark: Theme:
Science, Subtheme: Physical Science,
Facet: Astronomy

Cultural Affiliation

Significant Person

Architect/Builder

S. E. Todd

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

Summary

The 36-inch Clark refractor, housed in the Lick Observatory building, was the first large telescope erected on a site chosen for its astronomical advantages, rather than for convenience in the builder's backyard, or on a university campus.² The location of the telescope on Mount Hamilton proved to be an excellent choice and provided an example that has been followed from 1888 until the present day. The discoveries of early Lick astronomers, starting with Shelburne Wesley Burnham, James E. Keeler, Edward Emerson Barnard, and their later successors, began a tradition of excellence at Lick that has had a profound impact in shaping the history of American astronomy in the twentieth century. These astronomers have contributed to almost every branch of research in the history of astronomy. By combining excellent equipment, a favorable location, and the proximity to the resources of the University of California, Lick established the pattern for large modern observatories that has continued to this day and has left a major imprint on modern astronomy.

History

Lick Observatory was opened in 1888, around the 36-inch refractor, financed by California businessman James Lick. Planned from the beginning for use by a large staff of astronomers for their individual research programs, the institution was built around the great Alvan Clark 36-inch refractor, housed in the main observatory building.

Prior to the establishment of Lick, few astronomers understood the advantages of mountaintop observing, or had even studied the problem of observatory site selection. Major telescopes had always been erected near universities or in cities in convenient locations. Building a major observatory on a mountaintop was unprecedented, but George Davidson, the head of the Pacific branch of the U.S. Coast and Geodetic Survey, a dedicated geodesist and astronomer, had traveled throughout California and knew from first-hand experience the advantages of a mountaintop

See continuation sheet

United States Department of the Interior
National Park ServiceNational Register of Historic Places
Continuation SheetSection number 8 Page 2

location. Davidson in his capacity as President of the California Academy of Sciences, often met with James Lick, a bachelor, to discuss the disposition of his large estate. During these meetings Lick and Davidson discussed topics relating to science and astronomy and the need for large telescopes. By 1873 Davidson's meetings with Lick were successful when he announced to the Academy of Sciences that Lick had agreed to finance the building of a large observatory in the Sierra Nevada Mountains. James Lick took a personal interest in evaluating various sites for the location of his observatory but the final decision in favor of Mount Hamilton, located east of San Jose, in the Diablo Mountain Range, was made by Thomas Fraser, James Lick's foreman at the Lick homestead, and close associate. Lick personally approved the selection of Mount Hamilton shortly before his death on October 1, 1876.

This selection proved to be a fortunate choice. The skies above the mountain were unusually transparent and Mount Hamilton was a sharp knife-edged mountain that caused little perturbation or turbulence in the airflow from the cool ocean current to the west.

The 36-inch lens for the Lick refractor was cast by a firm headed by Charles Feil, of Paris, France, and ground by the American firm of Alvan Clark, the premier telescope-making firm in the United States. At the time of its completion in 1886 the 36-inch lens was the largest in the world. The mounting for the telescope was completed by the engineering firm of Warner and Swasey, marking the successful entry of this company in the field and establishing their reputation in the mounting of large astronomical telescopes. In the years after the establishment of Lick, most major observatories in the country would turn to the Warner and Swasey Company to mount their telescopes.

After the trustees of James Lick's estate turned over control of the observatory to the University of California on June 1, 1888, Edward S. Holden, the first director of the Lick Observatory, established four major areas of scientific research for the 36-inch refractor. These included double star research, an area of long-standing interest to 19th-century astronomers; astrometry, the measuring of star positions; the preparation of an accurate photographic atlas of the moon; and, finally, spectroscopy--the study of the component colors in a star's light to determine the properties of that star.

Lick Observatory attracted the most famous names in 19th-century astronomy to use the 36-inch refractor. One of the first was Sherburne Wesley Burnham, the well known double star observer from Chicago. Burnham's presence, coupled with the famous 36-inch refractor and the unprecedented

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 8 Page 3

location, brought instant fame to the observatory. Burnham's work in discovering and cataloging hundreds of pairs of stars, so future astronomers could study their orbits, continued at Lick for many years and was basic to the future of astronomical research.

Also joining the staff was Edward Emerson Barnard who brought with him experience in a technique new to astronomy--photography. At Lick, Barnard photographed the sky with a passion and in 1892 visually discovered the fifth moon of Jupiter, later named Amalthea, the first after Galileo's discoveries. In all, four additional moons of Jupiter were discovered by other astronomers at Lick. In addition, Barnard assisted Lick's director, Edward S. Holden, in taking a series of photographic plates to create an atlas of the moon, while his photographs of the Milky Way showed astronomers the complex arrangement of the galaxy for the first time. Barnard's work at Lick pioneered the use of photography as a research tool in astronomy.

Another early Lick astronomer, James E. Keeler, completed pioneering work in the field of spectroscopy, by recording the spectra of stars and cataloging this information. Keeler's work in this field would eventually lay the groundwork for understanding the types of stars in the galaxy. Keeler's measurements would also enable astronomers to determine the solar system's motion with respect to the nearby stars and would prove the first step in the march to map out the motions of stars in the Milky Way. This, in turn, led to a better understanding of our Galaxy's contents, size, and dynamics.

Although many of the early astronomers at Lick Observatory went on to successful careers elsewhere, great things continued to happen at Lick. Heber D. Curtis extended Keeler's work by pushing forth the understanding that spiral nebulae are galaxies. Robert Grant Aitken followed in Burnham's tracks by discovering, cataloging, and studying thousands of double stars. William W. Campbell organized many solar eclipse expeditions that led to Robert J. Trumpler's confirmation of the general theory of relativity. Trumpler's studies of stars in clusters led to the discovery that dark matter absorbs light in space, one of the most important discoveries of twentieth-century astronomy.

In the 100 years since its establishment the Lick Observatory has left a major imprint on the history of astronomy in America. By combining excellent equipment, favorable location, and proximity to the resources of the University of California, Lick established the pattern for large modern observatories that has continued to this day.

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 8 Page 4

Footnotes

1. The descriptive material in this section was taken from the following sources:

Leslie Sweeney and John Gustafson, ed. "Lick Observatory" (University of California, 1984), pp. 2-14.

Siegfried Marx and Werner Pfau, Observatories of the World (New York: Van Nostrand Reinhold Company, no date), pp. 122-124.

Marian Card Donnelly, A Short History of Observatories (Eugene, Oregon: University of Oregon Books, 1973), pp. 117-120.

2. The historical background for this section was taken from the following sources:

Donald E. Osterbrock, et al., Eye on the Sky: Lick Observatory's First Century, (Berkeley, California: University of California Press, 1988), pp. 267-271.

John R. Gustafson, "Pioneering Astronomy at Lick Observatory," Astronomy Magazine, May 1988, pp. 6-15.

Marx and Pfau, op. cit., p. 124.

United States Department of the Interior
National Park ServiceNational Register of Historic Places
Continuation SheetSection number 9 Page 2Bibliography

Abell, George O. Exploration of the Universe. 4th ed., Philadelphia: Saunders College Publishing, 1982.

Asimov, Isaac. Eyes On The Universe. Boston: Houghton Mifflin Company, 1975.

Gustafson, John R. "Pioneering Astronomy at Lick Observatory," Astronomy Magazine, May 1988. pp. 6-15.

Kirby-Smith, H.T. U.S. Observatories: A Directory and Travel Guide. New York: Van Nostrand Reinhold Company, 1976.

Learner, Richard. Astronomy Through the Telescope. New York: Van Nostrand Reinhold Company, 1981.

Marx, Siegfried and Werner Pfau. Observatories of the World. New York: Van Nostrand Reinhold Company, no date.

Mumford, George S. "The Legacy of E.E. Barnard," Sky & Telescope, July 1987. pp. 30-34.

Osterbrock, Donald E., et al. Eye on the Sky: Lick Observatory's First Century. Berkeley, California: University of California Press, 1988.

Sweeney, Leslie and John Gustafson, ed. Lick Observatory: University of California. Berkeley, California: University of California, 1984.
(Brochure)

9. Major Bibliographical References

See Continuation Sheet

Previous documentation on file (NPS):

- preliminary determination of individual listing (36 CFR 67) has been requested
- previously listed in the National Register
- previously determined eligible by the National Register
- designated a National Historic Landmark
- recorded by Historic American Buildings Survey # _____
- recorded by Historic American Engineering Record # _____

See continuation sheet

Primary location of additional data:

- State historic preservation office
- Other State agency
- Federal agency
- Local government
- University
- Other

Specify repository: _____

10. Geographical Data

Acreage of property _____ less than 1 acre

UTM References

A

1	0	6	2	0	3	0	0
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4	1	3	3	3	7	0
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Zone Easting Northing

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Zone Easting Northing

C

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D

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See continuation sheet

Verbal Boundary Description

The boundary follows to the outside perimeter of the building.

See continuation sheet

Boundary Justification

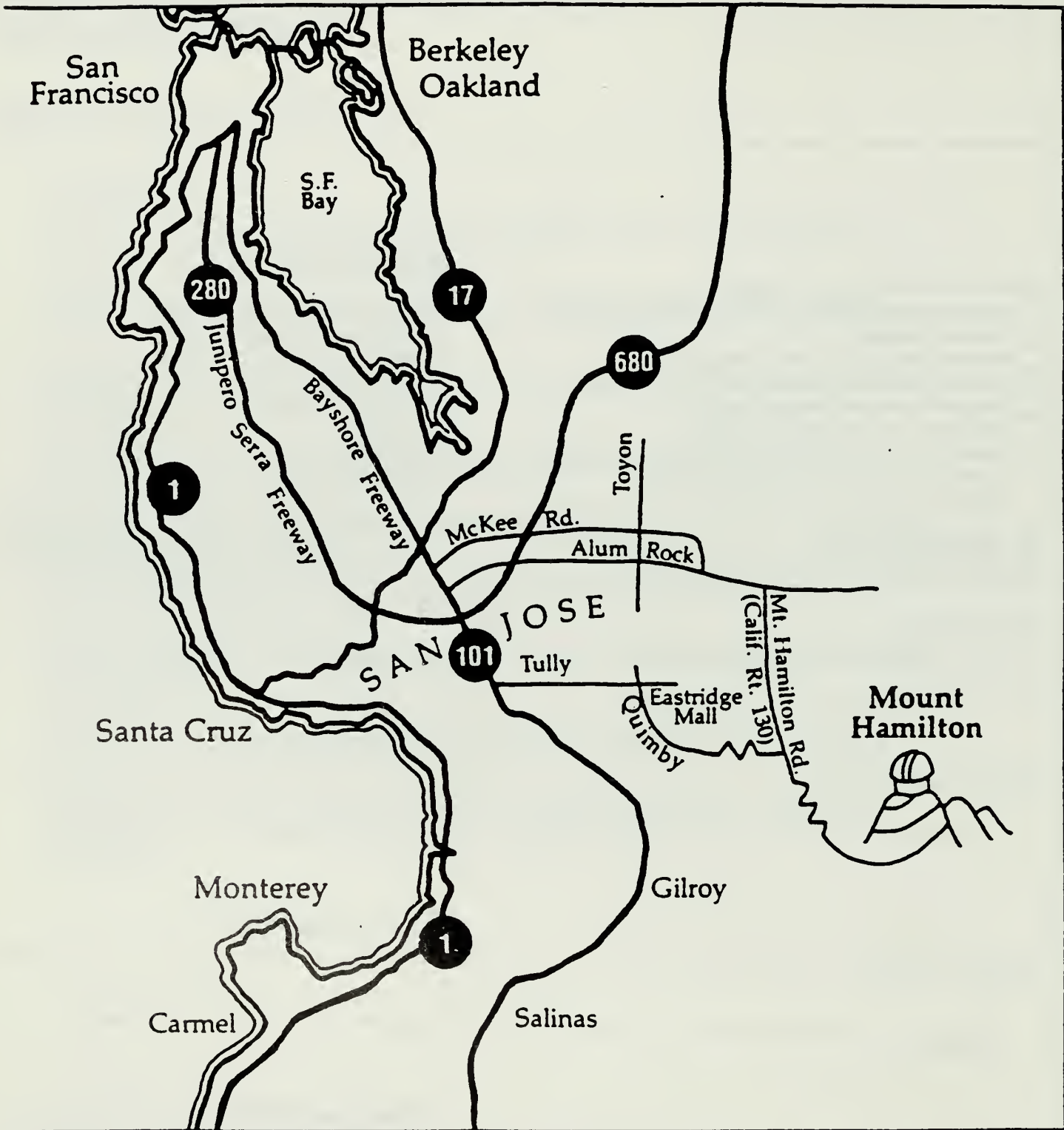
The boundary includes only the observatory building, which is the sole historic resource.

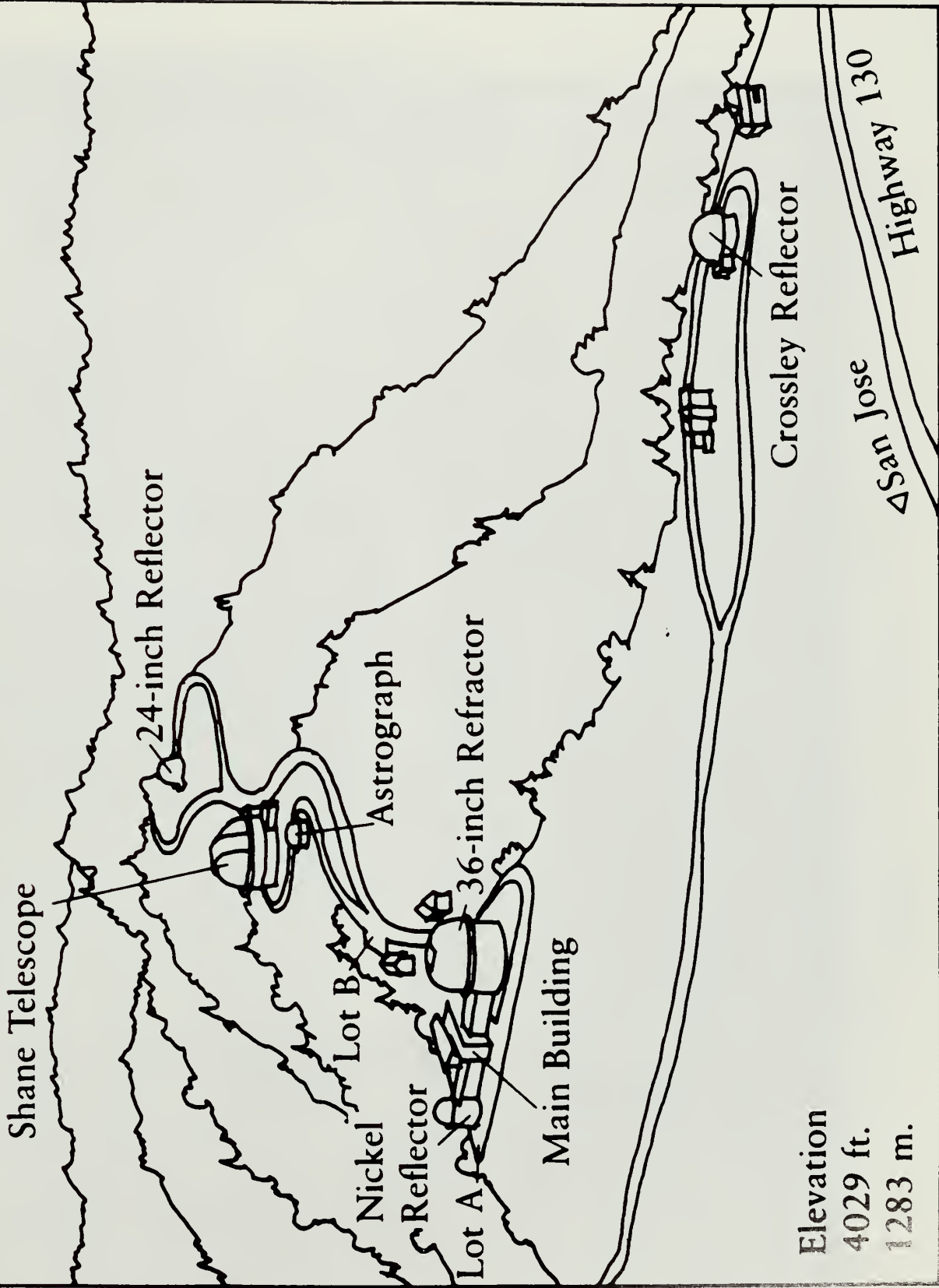
See continuation sheet

11. Form Prepared By

name/title Harry Butowsky date May 1, 1989
 organization National Park Service telephone (202) 343-8155
 street & number 1100 L Street, N.W. state DC zip code 20013
 city or town Washington

LICK OBSERVATORY

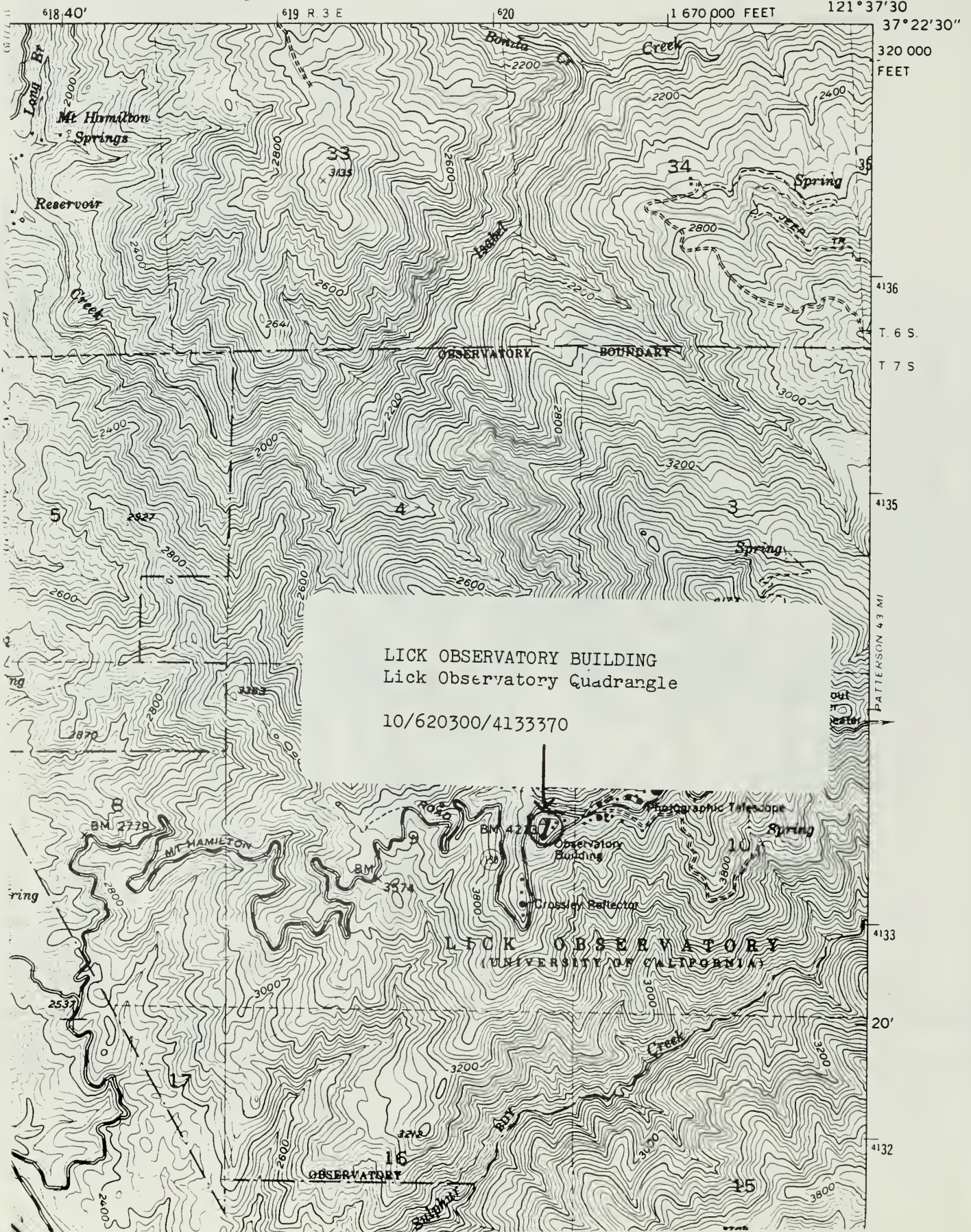




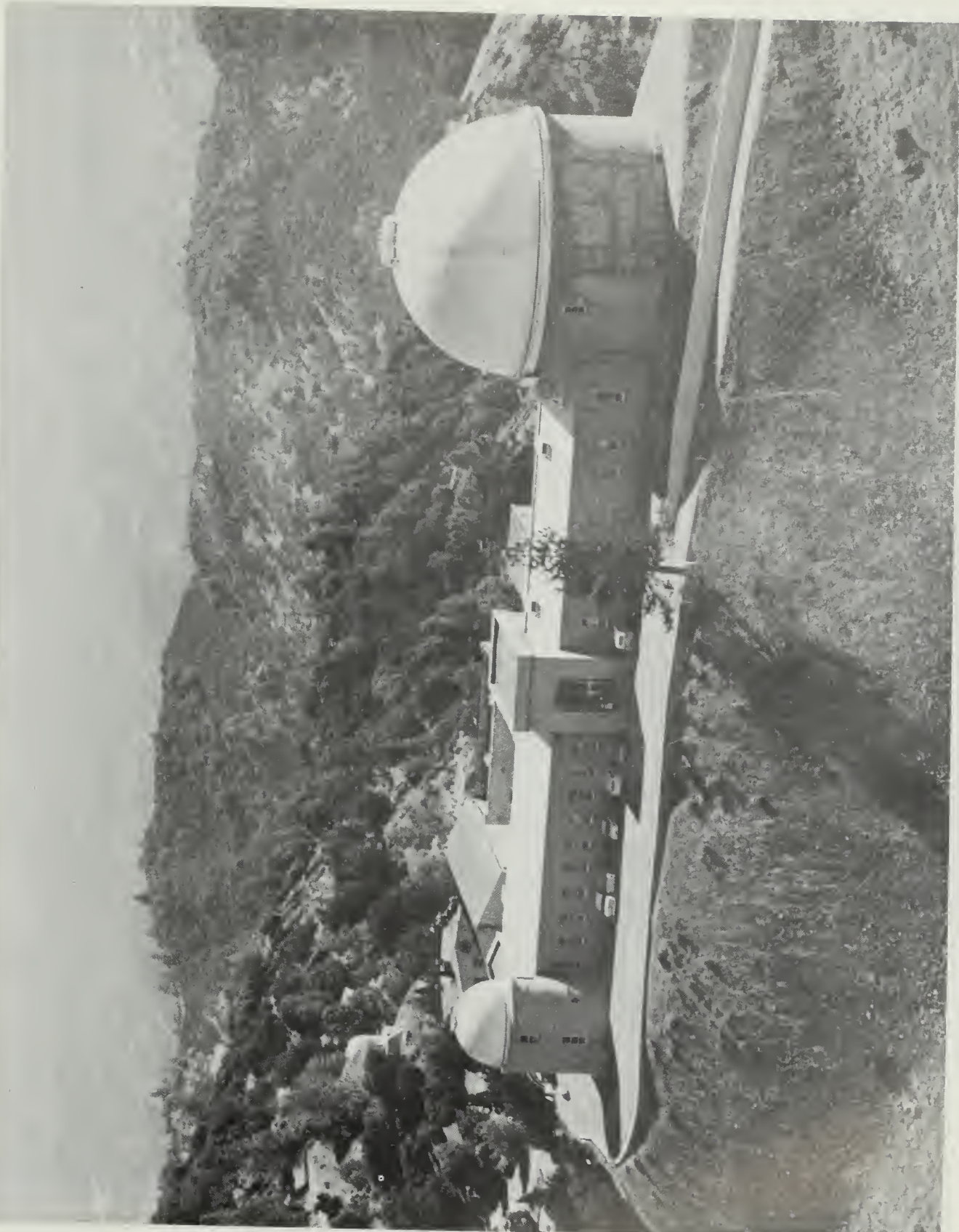
Elevation
4029 ft.
1283 m.

LICK OBSERVATORY QUADRANGLE
 CALIFORNIA-SANTA CLARA CO.
 7.5 MINUTE SERIES (TOPOGRAPHIC)

1658 (NE
 EYLAH MTN.)

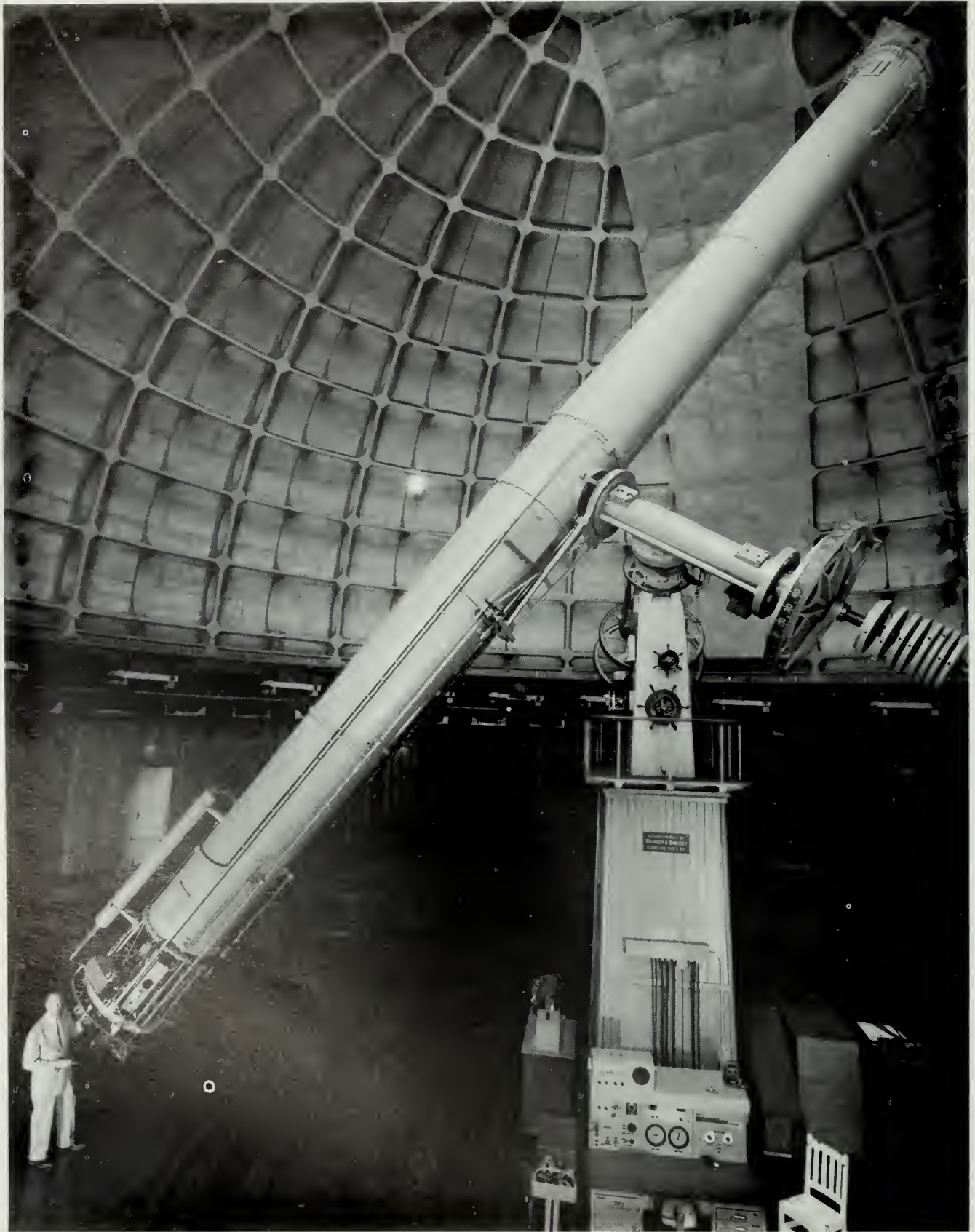


LICK OBSERVATORY BUILDING
 Lick Observatory Quadrangle
 10/620300/4133370



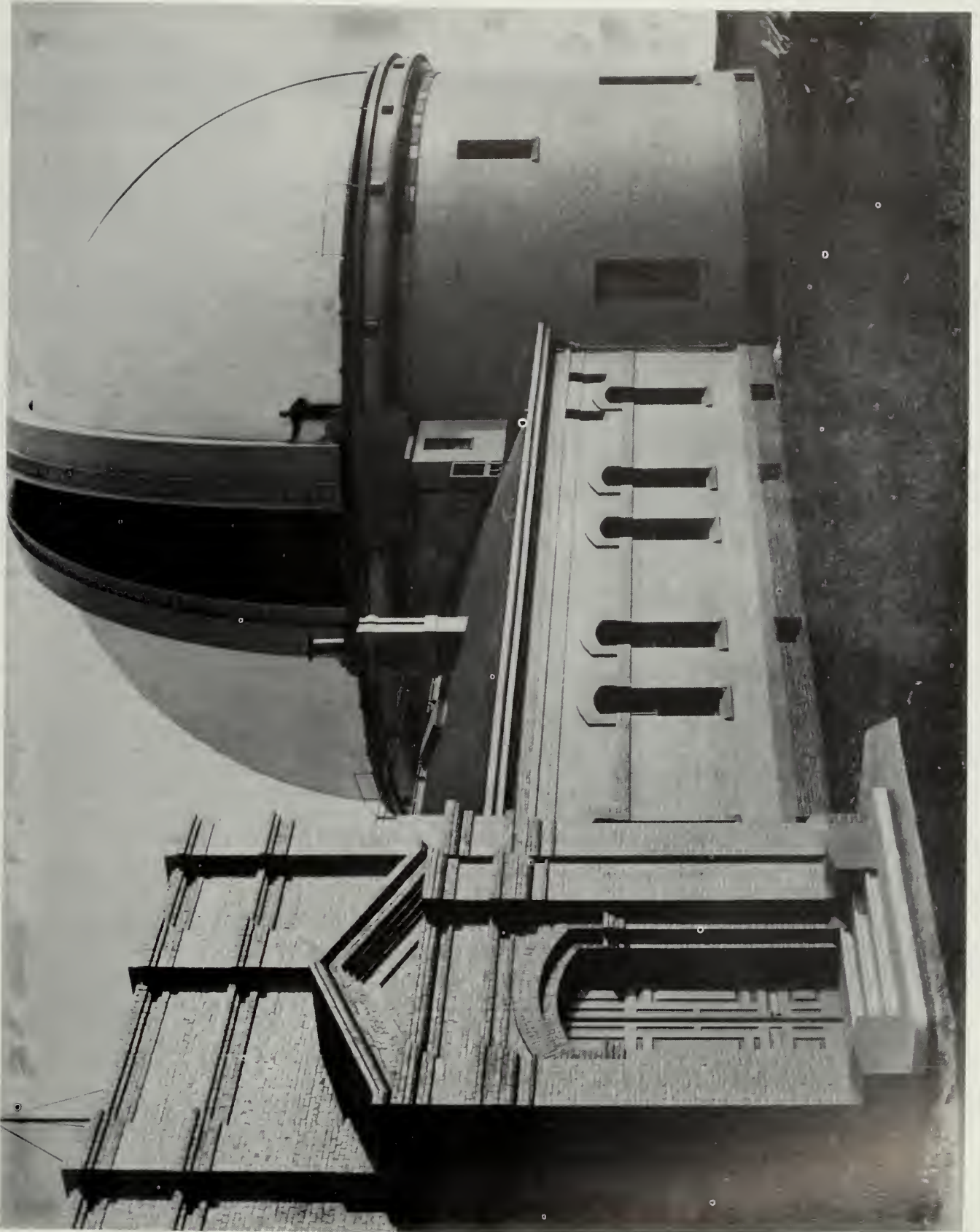
Lick Observatory — Mt. Hamilton, California
Exterior View of the Observatory from the West, 1952

Photo Credit: Lick Observatory



Lick Observatory — Mt. Hamilton, California
Interior View of the 36-inch Refractor, circa 1988

Photo Credit: Lick Observatory



Lick Observatory — Mt. Hamilton, California
Exterior Close-up View of the 36-inch Dome, circa 1988

Photo Credit: Lick Observatory

United States Department of the Interior National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in Guidelines for Completing National Register Forms (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name Crossley Reflector, Lick Observatory other names/site number Common's Reflector

2. Location

street & number Mount Hamilton city, town Santa Clara state California code CA county Santa Clara code 085 zip code 95064

3. Classification

Table with 3 columns: Ownership of Property, Category of Property, and Number of Resources within Property. Includes checkboxes for private, public-local, public-State, public-Federal, building(s), district, site, structure, object, and counts for contributing and noncontributing resources.

Name of related multiple property listing: Number of contributing resources previously listed in the National Register

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

5. National Park Service Certification

I, hereby, certify that this property is: entered in the National Register. determined eligible for the National Register. determined not eligible for the National Register. removed from the National Register. other, (explain:)

Signature of the Keeper Date of Action

6. Function or Use

Historic Functions (enter categories from instructions)

Current Functions (enter categories from instructions)

Education

Education

Research Facility

Research Facility

7. Description

Architectural Classification

(enter categories from instructions)

Materials (enter categories from instructions)

N/A

foundation concrete

walls concrete

roof iron

other

Describe present and historic physical appearance.

The Crossley 36-inch reflector at the Lick Observatory was built by British amateur astronomer Andrew Ainslie Common in England in 1876. Common planned the telescope, mounting, and housing himself while the 36-inch silver-on-glass reflector mirror was designed and built by the English telescope maker G. Calver. ¹

To minimize convective thermal disturbances of the image from any large masses of metal near the optical path, Common placed the primary mirror above the declination axis, within a rigid but lightweight open framework, supported by an equatorial fork mount. Counterweights were carried in boxes below the mirror and below the declination axle. The polar axis was partially floated in mercury to reduce friction, an innovation which was applied years later to both the 60-inch and 100-inch telescopes at the Mount Wilson Observatory. The telescope was stored horizontally in a small wooden house with a sliding roof. The house had an exterior platform on inclined ways to give access to the Newtonian focus. The housing and platform could be rotated as a unit to the desired azimuth.

In 1885 Common sold the 36-inch reflector to another British amateur astronomer, Edward Crossley, who moved it to his estate near Halifax in Yorkshire, England. The two 36-inch mirrors Common ordered for the telescope were included in the sale. Mirror A, the one used by Common, was installed in the telescope, while mirror B, also made by Calver, was sent to an optical firm in Dublin, Ireland, to be refigured.

Since the observer's working area on the platform for the telescope was too exposed to the weather, Crossley designed and constructed a substantial dome to house the telescope. The new dome was 39 feet in diameter and covered with 1/12-inch galvanized iron. The dome weighed 15 tons and was driven by a water engine that turned it through a complete revolution in five minutes. Pipes under the floor carried hot or cold water to heat and cool the dome when not in use. The observer's platform was suspended inside the dome and rotated with it.

See continuation sheet

United States Department of the Interior
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National Register of Historic Places
 Continuation Sheet

Section number 7 Page 2

By 1893 Crossley became dissatisfied with the climate of England for astronomical work and decided to dispose of the 36-inch reflector and dome. After an exchange of letters with Edward S. Holden, the director of the Lick Observatory, Crossley agreed to donate his telescope to Lick.

During the summer of 1895 the large 36-inch reflector was taken down and shipped to California. The massive dome built to house the telescope was also sent to Lick. By June 1896 the telescope was installed on Mount Hamilton and ready for operation. Since it was not possible to use Crossley's water engine to turn the dome due to the lack of running water on the mountain, the dome was turned instead by a rope and pulley system. One arm's-length pull of the rope was necessary to move the dome one inch.

The telescope was equipped with the f/5.8 newly refigured mirror B, which proved to be of excellent quality. However, due to problems in the original mounting, it proved difficult to take satisfactory long exposures.

On January 1, 1898, James E. Keeler assumed the directorship of the Lick Observatory and began to work with the Crossley reflector. Keeler immediately began to make modifications to the telescope to improve its optical qualities and working characteristics. Keeler cut down the pier that mounted the telescope by two feet, thus lowering the telescope by a similar amount to provide more clearance between it and the dome. At the same time the top of the pier was finished off with a slight bevel, so that the polar axis was parallel to the axis of the rotation of the Earth. These changes in the mounting of the telescope were necessary to compensate for the difference in latitude between Common's observatory in England and Mount Hamilton. Other modifications included the addition of a windscreen, a new and smoother drive clock and improvements to the drive train and double-sided plate holder. Keeler also adjusted the mirror of the telescope so that its optical axis was accurately aligned with the center of the tube, and added a new low-power finder telescope, for picking the right area of the sky, to work with the existing high-power telescope. The latter was given a new and lighter-weight mounting.

Although Keeler was able to work successfully with the telescope and produce exposures up to four hours by 1899 the instrument still proved difficult to handle and inadequate for longer observations. The major problem was the insufficiently rigid mounting, which failed to hold the telescope steady in high winds and flexed excessively at large zenith distances. Adding to these problems was the occasional slippage of the mirror in its cell.

United States Department of the Interior
National Park ServiceNational Register of Historic Places
Continuation SheetSection number 7 Page 3

James Keeler produced a large number of scientific papers based on his work with the Crossley before he died on August 12, 1900.

The next astronomer to work with the Crossley was Charles Dillon Perrine, who in 1900-1901, used the telescope to take nearly one thousand photographs of the minor planet Eros as it approached the Earth. Although Perrine continued to use the Crossley with good results, he was dissatisfied with its performance and operation. Perrine was determined to improve the telescope and in the years from 1902 to 1905, oversaw a reconstruction of the telescope, which brought it into its modern form.

Perrine replaced Common's original tube and mount with a much more rigid closed tube on an English equatorial mounting. The Newtonian flat mirror, which brought the light out to a focus at the side of the tube, was removed and, in its place, Perrine introduced a plateholder directly at the prime focus of the telescope in the middle of the upper end of the tube.

Perrine also introduced a system of prisms and transfer lens so that the observer could "guide" or accurately follow the motion of the stars during the exposure from an eyepiece just outside of the tube. With these modifications, the Crossley became a faster and more efficient telescope for photographing nebulae and star fields.

The Crossley remained unchanged until 1934 when the large 36-inch mirror was coated with aluminum, thus increasing its light-gathering capacity. In the early 1950s, the drive mechanism of the telescope was replaced. The polar axis was turned end for end so that a worm gear could now be used to drive the telescope from the south polar axle housing, and an electronic clock replaced the old mechanical clock. In the late 1960s Selsyn telescope-position readouts were installed at the observing end of the instrument, and the observer's platform was enlarged and strengthened to carry the additional electronic equipment required by modern observational techniques. A large bearing was installed to ease rotation of the top section of the tube. Finally, a modern darkroom was built.

The Crossley 36-inch reflector is found a few hundred yards southwest of the Main Observatory Building of the Lick Observatory and is still in use as an operational scientific instrument for the study of the stars and galaxies.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

nationally statewide locally

Applicable National Register Criteria A B C D NHL Criteria 1

Criteria Considerations (Exceptions) A B C D E F G

Areas of Significance (enter categories from instructions)

Period of Significance

Significant Dates

National Register Significance

1898-Present

1898-Present

Education, Engineering, Science

National Historic Landmark: Science,

Cultural Affiliation

Subtheme: Physical Science, Facet:

N/A

Astronomy

Significant Person

Architect/Builder

James Keeler/Charles Perrine

Andrew Common/Charles Perrine

Robert Trumpler

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

Summary

The Crossley 36-inch reflector at the Lick Observatory was the first of a long line of metal-film-on-glass modern reflecting telescopes that have dominated major astronomical advances for the past century. In addition, the Crossley has produced more scientific results than any other telescope of its size, including several historically important studies in stellar evolution, the structure and spectra of planetary nebulae, and the discovery and spectral analysis of faint variable stars in young clusters. The Crossley also contributed to studies that confirmed the expansion of the universe.

History

The Crossley 36-inch reflecting telescope, at the Lick Observatory, marked the first modern application of a reflecting telescope to astronomical studies.²

In 1789 Sir William Herschel built a reflecting telescope with a 48-inch polished mirror, but the telescope was difficult to point and the mirror needed constant polishing. Shortly thereafter, the two-component lens was developed and refractors became the telescope of choice. Despite the many advantages of reflectors over refractors, it was not until 1880, when the technique of making concave silver-surfaced glass mirrors was perfected, that reflectors again assumed importance in astronomy.³

One of the earliest such telescopes was the 36-inch reflector built by British amateur astronomer Andrew Common. Common's telescope was built around a 36-inch silver-on-glass mirror that was mounted on an equatorial fork and used as a photographic telescope. The chief innovations in Common's telescope were the achievement of a smooth drive by relieving the bearings of almost the entire weight of the telescope, and the invention of an adjustable plate holder. The bearing load was diminished by submerging a hollow steel float in mercury, while the plateholder had an

See continuation sheet

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 8 Page 2

eyepiece and crosswire attached so that a star just off the edge of the plate could be watched and, if it drifted away from its starting position, be brought back by moving the plateholder. The end result showed that it was possible to build a telescope that was sufficiently smoothly and accurately enough driven to allow very good photographs to be taken.⁴ By 1881 Common published a description of his 36-inch reflector, introducing the paper with a list of ten conditions vital for the successful operation of a large reflecting telescope. The last of these conditions was a suitable location for the erection of the telescope.⁵

In 1885 Common sold his 36-inch reflecting telescope to Edward Crossley of Halifax, Yorkshire, England, who donated the telescope to the Lick Observatory shortly after his retirement from astronomy in 1893.

Crossley's donation of his telescope to Lick was fortuitous. For the first time a large reflecting telescope was located on a suitable mountain site where its large aperture could be used to its fullest advantage.

Within a short time the Crossley reflector was put to good use when James E. Keeler initiated a program of nebular photography with it. Keeler's photographs showed the existence of hundreds of spiral nebulae that are now known as galaxies. Neither Keeler nor anyone else at the time realized that nebulae were predominantly extragalactic, but Keeler, using Crossley photographs, was the first to realize that these objects were a major constituent of the universe. After Keeler's death, astronomer C.D. Perrine completed Keeler's observational program, and in 1908 published a remarkable selection of Crossley photographs in memory of Keeler. Keeler's and Perrine's success with the Crossley reflector was probably more influential than any other single factor in convincing professional astronomers of the practical effectiveness of large reflectors.⁶

By the early 1900s, as a result of Keeler's and Perrine's work with the Crossley, it was apparent that the future of large telescopes lay with mirrors rather than lenses. A few years later, when George Ellery Hale began to plan for the establishment of a large observatory on Mount Wilson in California, the use of a large refracting telescope was not even considered. The Crossley had shown the way to the future of astronomy. Large reflecting telescopes would now dominate 20th-century astronomy.

In the years since the early 1900s astronomers at Lick have used the Crossley for several historically important studies in stellar evolution, including the structure and spectra of planetary nebulae and the discovery and spectral analysis of faint variable stars in young clusters. The Crossley has also contributed to studies confirming the expansion of the universe.

United States Department of the Interior
National Park ServiceNational Register of Historic Places
Continuation SheetSection number 8 Page 3

In 1908 astronomer Edward A. Fath, using data collected with the Crossley reflector, established that none of the spirals observed had continuous spectra, but were in his opinion, clusters of individual stars. His conclusion was that spiral nebulae must be very distant and composed of very faint stars.

Building upon the work of Keeler, Perrine, and Fath, astronomer Heber D. Curtis devoted his efforts with the Crossley toward a better understanding of the nature of spiral nebulae. In 1912 and 1913 Curtis published extensive lists and descriptions of the brighter nebulae and clusters that he photographed using the Crossley. Curtis' observations of numerous faint novae in the nebulae he photographed with the Crossley led to his conclusion that the nebulae were far more distant from the Earth than had previously been thought. Curtis concluded the nebulae were beyond our own galaxy. Curtis led the way in pushing forth the understanding of spiral nebulae as galaxies, giant island universes, external to our galaxy. In arriving at this view Curtis collided head on with astronomer Harlow Shapley, who held the opposite point of view in the famous 1920 Curtis Shapley debate held before the National Academy of Sciences, in Washington, DC.

In 1930 astronomer Robert J. Trumpler used data obtained from the Crossley to publish his classic paper in which he examined the distances, dimensions and space distributions of open star clusters. Trumpler proved conclusively that our galaxy does contain a layer of absorbing gas and dust which attenuates light of different colors by different amounts. By properly taking into account this attenuation, Trumpler's work led to considerably smaller dimensions for our galaxy than had previously been considered.

Continued contributions made by astronomers using the Crossley telescope in this century are almost endless. Comets, asteroids, and satellites of the planets were regularly discovered. There were many studies of novae, planetary nebulae and their central stars, star clusters, and interstellar medium. Variable stars received attention, especially after photoelectric photometry became popular. In more recent years the Crossley has continued to be used as a scientific instrument, producing important new information in the study of astronomy.

The Crossley reflector was the first large reflecting telescope put into operation and used by astronomers at a first-class site. Using the Crossley, James Keeler and other astronomers at Lick determined the success of the reflector design for all subsequent large telescopes. Once the Crossley was in operation on Mount Hamilton, the future path of astronomical research in the 20th century, based on large reflecting telescopes, was determined. While larger and more powerful reflecting telescopes were built, all would be, in a sense, the technological descendants of the Crossley.

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 8 Page 4

Footnotes

1. The descriptive material in this section was taken from the following sources.

Donald E. Osterbrock, et al., Eye on the Sky: Lick Observatory's First Century (Berkeley, California: University of California Press, 1988).

Donald E. Osterbrock, James E. Keeler: Pioneer American Astrophysicist and the Early Development of American Astrophysics (Cambridge, England: Cambridge University Press, 1984).

Remington P. S. Stone, "The Crossley Reflector: A Centennial Review - I," Sky and Telescope Magazine, October 1979, pp. 307-311.

_____, "The Crossley Reflector: A Centennial Review - II," Sky and Telescope Magazine, November 1979, pp. 396-400.

2. Leslie Sweeney and John Gustafson, ed. "Lick Observatory" (University of California, 1984), p. 16.
3. Ibid.
4. Richard Learner, Astronomy Through the Telescope (New York: Van Nostrand Reinhold Company, 1981), p. 109.
5. Ibid.
6. Stone, I, op. cit., p. 311.
7. Stone, II, op. cit., p. 398.

**United States Department of the Interior
National Park Service**

**National Register of Historic Places
Continuation Sheet**

Section number 9 Page 2

Bibliography

Abell, George O. Exploration of the Universe. 4th ed., Philadelphia: Saunders College Publishing, 1982.

Asimov, Isaac. Eyes On The Universe. Boston: Houghton Mifflin Company, 1975.

Gustafson, John R. "Pioneering Astronomy at Lick Observatory," Astronomy Magazine, May 1988, pp. 6-15.

Kirby-Smith, H.T. U.S. Observatories: A Directory and Travel Guide. New York: Van Nostrand Reinhold Company, 1976.

Learner, Richard. Astronomy Through the Telescope. New York: Van Nostrand Reinhold Company, 1981.

Marx, Siegfried and Werner Pfau. Observatories of the World. New York: Van Nostrand Reinhold Company, no date.

Osterbrock, Donald E. James E. Keeler: Pioneer American Astrophysicist. Cambridge, England: Cambridge University Press, 1984.

Osterbrock, Donald E., et al. Eye on the Sky: Lick Observatory's First Century. Berkeley, California: University of California Press, 1988.

Stone, Remington, P. S. "The Crossley Reflector: A Centennial Review - I," Sky & Telescope Magazine, October 1979, pp. 307-311.

_____. "The Crossley Reflector: A Centennial Review - II," Sky & Telescope Magazine, November 1979, pp. 396-400.

Sweeney, Leslie and John Gustafson, ed. Lick Observatory. Berkeley, California: University of California, 1984.

9. Major Bibliographical References

See Continuation Sheet

Previous documentation on file (NPS):

- preliminary determination of individual listing (36 CFR 67) has been requested
- previously listed in the National Register
- previously determined eligible by the National Register
- designated a National Historic Landmark
- recorded by Historic American Buildings Survey # _____
- recorded by Historic American Engineering Record # _____

See continuation sheet

Primary location of additional data:

- State historic preservation office
- Other State agency
- Federal agency
- Local government
- University
- Other

Specify repository: _____

10. Geographical Data

Acreage of property less than 1 acre

UTM References

A

1	0	6	2	0	2	0	0	4	1	3	3	0	5	0
Zone	Easting				Northing									

C

Zone	Easting				Northing									

B

Zone	Easting				Northing									

D

Zone	Easting				Northing									

See continuation sheet

Verbal Boundary Description

The boundary follows to the outside perimeter of the building.

See continuation sheet

Boundary Justification

The boundary includes only the observatory building, the sole resource which is nationally significant.

See continuation sheet

11. Form Prepared By

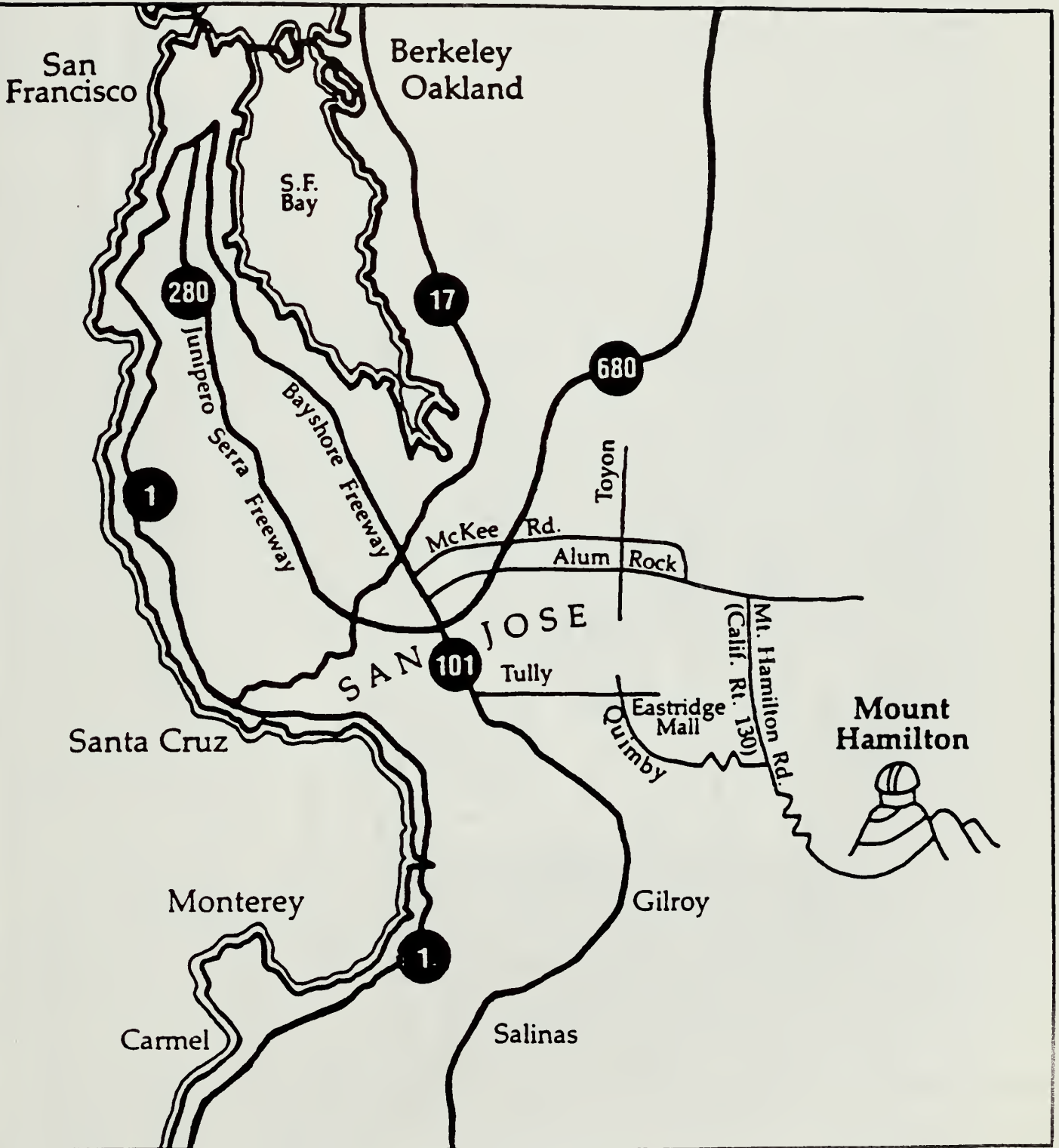
name/title Harry Butowsky

organization National Park Service date May 1, 1989

street & number 1100 L Street, N.W. telephone (202) 343-8155

city or town Washington state DC zip code 20013

LICK OBSERVATORY



LICK CROSSLEY REFLECTOR

Shane Telescope

24-inch Reflector

Astrograph

Nickel Reflector

36-inch Refractor

Main Building

Crossley Reflector

Elevation
4029 ft.
1283 m.

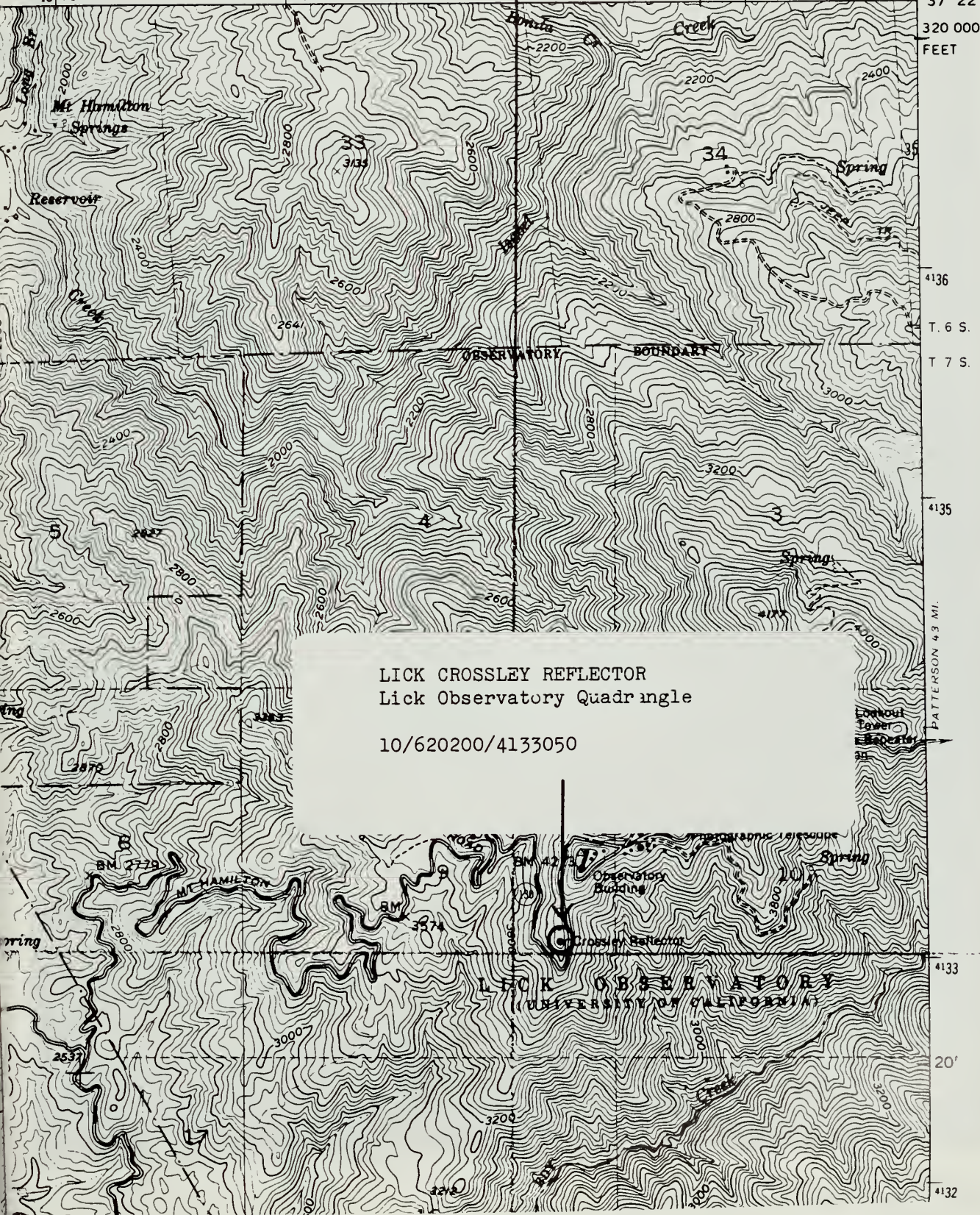
San Jose

Highway 130

LICK OBSERVATORY QUADRANGLE
CALIFORNIA-SANTA CLARA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

1658 I NE
(EYLAR MTN.)

618 40' 619 R 3 E. 620 1 670 000 FEET 121°37'30 37°22'30"

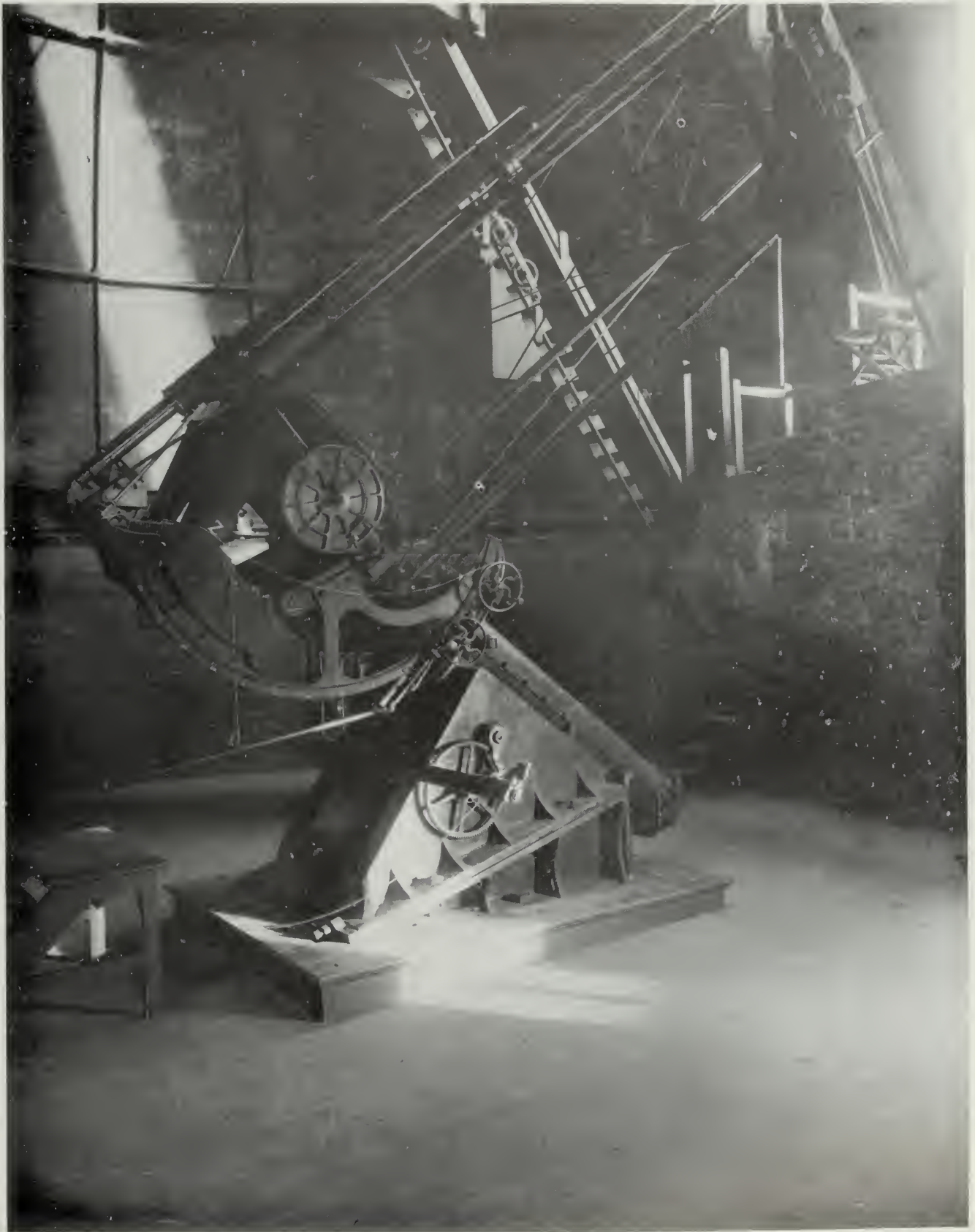


LICK CROSSLEY REFLECTOR
Lick Observatory Quadrangle
10/620200/4133050



Lick Observatory — Mt. Hamilton, California
Exterior View of the Crossley 36-inch Reflector Building, 1988

Photo Credit: Lick Observatory



Lick Observatory — Mt. Hamilton, California
Crossley 36-inch Reflector, 1900

Photo Credit: Lick Observatory



Lick Observatory — Mt. Hamilton, California
Crossley 36-inch Reflector, 1988

Photo Credit: Lick Observatory

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United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name Mount Wilson Observatory
other names/site number Mount Wilson Observatory

2. Location

street & number Mount Wilson not for publication
city, town Angeles National Forest vicinity
state California code CA county Los Angeles code 037 zip code 91101

3. Classification

Ownership of Property	Category of Property	Number of Resources within Property	
<input checked="" type="checkbox"/> private	<input checked="" type="checkbox"/> building(s)	Contributing	Noncontributing
<input type="checkbox"/> public-local	<input type="checkbox"/> district	_____	<u>21</u> buildings
<input type="checkbox"/> public-State	<input type="checkbox"/> site	_____	_____ sites
<input checked="" type="checkbox"/> public-Federal	<input checked="" type="checkbox"/> structure	<u>5</u>	<u>8</u> structures
	<input type="checkbox"/> object	_____	_____ objects
		<u>5</u>	<u>29</u> Total

Name of related multiple property listing: _____ Number of contributing resources previously listed in the National Register 0

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this _____ nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of certifying official _____ Date _____

State or Federal agency and bureau _____

In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of commenting or other official _____ Date _____

State or Federal agency and bureau _____

5. National Park Service Certification

I, hereby, certify that this property is:

entered in the National Register.
 See continuation sheet.

determined eligible for the National Register. See continuation sheet.

determined not eligible for the National Register.

removed from the National Register.

other. (explain: _____)

6. Function or Use

Historic Functions (enter categories from instructions)

Research Facility

Education

Current Functions (enter categories from instructions)

Research Facility

Education

7. Description

Architectural Classification

(enter categories from instructions)

N/A

Materials (enter categories from instructions)

foundation concrete, masonry, wood

walls _____

roof steel

other _____

Describe present and historic physical appearance.

Mount Wilson Observatory, placed in operation in 1904, was the second (after Lick) of the great astronomical research observatories to be established in the Far West. The observatory, at 5,710 feet altitude, is located in the Angeles National Forest on a 1,050-acre plateau at the summit of Mount Wilson. All of the major research telescopes described below, with the exception of the 100-inch Hooker reflector, are in operation. The 100-inch Hooker reflector was mothballed by the Carnegie Institution (operator of the observatory since 1904) in 1985 due to lack of funds. Mount Wilson Observatory is in Los Angeles County, 20 miles east of Los Angeles on State Highway 2.¹

Snow horizontal solar telescope

The Snow horizontal solar telescope was built at a cost of \$10,000 for the use of the Yerkes Observatory in Wisconsin, with funds provided by Helen Snow. Due to poor visual conditions at the Wisconsin site, Hale had the telescope shipped to the Mount Wilson Observatory, where it was carried up the mountain, piece by piece, on the backs of mules following a dirt trail only four feet wide. When assembled in 1905 the Snow horizontal solar telescope became the first permanent telescope to be placed on the mountain.

The Snow telescope contains a coelostat, or slowly revolving mirror, on a clock-driven mounting, that receives light from the sun and is reflected to a plane mirror 30 inches in diameter. From this mirror the beam is reflected nearly horizontally to a point 100 feet north, where it falls on a telescope with a 24-inch concave mirror of 60-foot focal length, thus forming a solar image about 6.5 inches in diameter. Because the path over which the beam of sunlight has to pass is very long, Hale raised the telescope high above the ground on a series of stone piers, to protect the beam of light from distortions caused by rising hot air. The telescope is covered by a long corrugated metal shed to protect its working parts from the elements.

The horizontal design of the Snow telescope was soon superseded by solar telescopes using a vertical design that provided a clearer image of the sun. The Snow telescope is only lightly used today for solar and night-time studies that require a stable platform and a large aperture (24-inch) mirror.

See continuation sheet

United States Department of the Interior
National Park ServiceNational Register of Historic Places
Continuation SheetSection number 7 Page 2The 60-foot solar telescope

The horizontal design of the Snow telescope proved unsatisfactory because of heat rising from the ground that caused mirror distortion and air turbulence. To solve this problem, Hale designed a vertical telescope in 1907--the 60-foot Solar telescope.

This instrument employs a 60-foot tower to house a 12-inch coelostat, a 22 x 12.5-inch elliptical flat mirror and a 12-inch objective doublet with a focal length of 60 feet. Both mirrors are 12 inches thick to prevent rapid distortion due to solar heating. A laboratory at the base of the tower contains a 30-foot underground spectroheliograph, sunk into the bedrock of the mountain, which produces a 6-inch solar image. The mirrors of the telescope are attached to motorized mountings in an assembly housed in a small white dome 60 feet above the ground.

In order to prevent the instrumentation from buffeting in the wind, the telescope has two towers for structural stability. The larger outer tower supports the dome, while the smaller inner tower supports the mirror and lenses. The siting of the spectroheliograph in a pit dug 30 feet into the bedrock of the mountain, below the telescope, provides a stable vibration-free location calculated to produce sharp images of the sun.

In the years since 1907, the 60-foot solar telescope has remained in constant use. While the basic design and structure of the telescope has remained intact, recent improvements include the installation of an automatic guiding system to provide a stable light feed to a tuneable magneto-optical filter that is mounted on the spectrograph table. A computer system for data handling and reduction has been installed in a specially constructed building next to the tower. The 60-foot solar telescope is still in use.

The 150-foot solar telescope

With the success of the 60-foot solar telescope, Hale proposed a 150-foot solar telescope of a similar design to achieve an even larger image. The Carnegie Institution provided the funds and the telescope was completed by 1912.

The tower is of double construction. The outer tower supports the dome and protects the inner optical support tower from wind and vibration. The mirrors are fitted with water jackets for cooling, and the 12-inch objective is a triplet designed to minimize the secondary spectrum. The instrument pit containing the spectroheliograph is located 75 feet into the bedrock of the mountain. The motorized mirrors in the small dome 150 feet above the ground focus an image of the sun 17 inches across onto a table in the building at the base of the telescope.

United States Department of the Interior
National Park Service

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Continuation Sheet

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The 150-foot solar telescope has been expertly maintained and upgraded over the years. Recent modifications include the installation of a computerized data handling system, a new grating and new exit and entrance slit assemblies. The 150-foot solar telescope is in use and remains one of the best facilities in the world for solar observation.

The 60-inch reflector

The 60-inch reflector at Mount Wilson was constructed in 1908. Hale used the 60-inch glass blank that his father purchased for him in 1896. George Ritchey finished the glass blank into a mirror of the proper size in the Mount Wilson optical shops in Pasadena, California. Ritchey also designed the tube and mounting for the telescope, which were built by the Union Iron Works in San Francisco. The design drew heavily on experience gained with the use of the 36-inch Crossley reflector at the Lick Observatory.

The telescope is supported by a 15-foot tube, which contains eight separate steel tubes and cross-braces designed to provide a stiffer truss and support system than was originally found in the Crossley reflector. The mirror is supported by a system of levers in a steel housing attached to the bottom of the tube and is fork-mounted on the polar axis. Just below the fork is a 10-foot diameter mercury float-bearing system designed to carry the weight of the telescope. The telescope is moved with electric motors. The 58-foot dome of the telescope is built from steel, on a concrete foundation, with double walls for the free circulation of air. This design is necessary to minimize temperature variations which could alter the shape of the mirror.

Hale designed the optical system of the 60-inch reflector so that the instrument could be used for a variety of purposes. As a Newtonian telescope it was an f/5 instrument for photography and low-dispersion spectroscopy. In a modified Cassegrain configuration, using a convex hyperboloidal mirror before the prime focus and a plane mirror at the lower end of the tube to reflect light to the

side of the tube, it could be used at f/16 for spectrography and an f/20 for photography. Finally, as an f/30 Coude, light was reflected by an appropriately geared mirror through the hollow polar axis into a constant-temperature room housing a large spectrograph. This flexible optical system, which allowed the telescope to be used for photographic and spectrographic purposes, was a model for future large reflectors.

The 60-inch reflector was upgraded mechanically and electrically in 1967. In 1977 the telescope was equipped with a spectrometer for the study of stellar magnetic activity; in 1980 a minicomputer was added to record data from this spectrometer. The 60-inch reflector is in use as an important research telescope.

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The 100-inch Hooker reflector

While the 60-inch reflector was under construction, George Ellery Hale began to plan an even larger telescope. In 1906 with the support of a \$45,000 grant from wealthy Los Angeles industrialist J.D. Hooker, Hale ordered a 100-inch blank disk, made from wine-bottle glass, from the St. Gobain glass works in France.

After several failures, a satisfactory disk was cast in 1910 and shipped to Pasadena for polishing. Despite some flaws in the glass, Hale persuaded his friend George Ritchey to begin the long process of grinding the glass into the required shape. When Ritchey finished, the 100-inch mirror weighed about 9,000 pounds.

In 1910 Hale and Hooker persuaded the Carnegie Institution to grant \$500,000 to complete the construction of the telescope. The preliminary design of the dome was drawn up by members of the observatory staff and turned over to the firm of Daniel H. Burnham, in Chicago, for completion. The English yoke mounting for the telescope was designed by Ritchey and then modified by Hale and another member of the Mount Wilson staff, Francis Pease. The use of the English yoke mounting to provide much stiffer support for the telescope meant that the instrument could never see the stars near the north celestial pole.

In 1915 the Fore River Shipbuilding Company of Quincy, Massachusetts, began sending the various components of the mounting to Pasadena. Since the parts were too large and heavy for the old road to the top of the mountain, a new road, widened to 12 feet, had to be built.

To support the telescope, a concrete pier 33 feet high was built into the bed-rock of the mountain. At the bottom the pier is a rectangle 20 x 45 feet across, while the top mushrooms out to a circular observing floor, 54 feet in diameter, supported by two massive concrete support brackets. Within the hollow structure of the pier are several floors used for storage and darkroom space. Equipment to re-silver the huge mirror is found just under the telescope.

By July 1917 the mounting was assembled and ready for the installation of the 100-inch mirror. By 1919 the Hooker reflector was in regular operation and producing useful scientific data. The final cost of the telescope to Carnegie was \$600,000, not including the labor of the Mount Wilson staff, or the original contribution by Hooker.

Optically, the Hooker telescope is very similar to the 60-inch telescope. It can be used as an f/5 Newtonian, f/16 modified Cassegrain, or an f/30 Coude. In the latter case the beam is brought through the hollow polar axis into a constant temperature room in the south pier for high-dispersion spectrography.

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Section number 7 Page 5

The polar axis of the telescope, on which the 87-ton instrument must turn smoothly to counteract the rotation of the Earth, is defined by self-aligning journal bearings, while the bulk of the load is carried by two steel drums that float in mercury. The resulting friction is so low that the telescope, with 200,000 pounds of moving parts, can be rotated by the force of one hand at the end of the tube.

To rotate the telescope, a large worm gear 18 feet in diameter is mounted on the south end of the polar axle. The gear, of cast iron with hollow spokes, is made in two halves bolted together. It meshes with a tool-steel worm that is rotated by a mechanical driving clock at one turn per minute. Because of the accuracy required in tracking the stars as they move across the night sky, great precision was required in cutting the teeth of the worm gear. This operation was done by the Italian instrument maker, C. Jacomini, with the gear in place on the telescope. Using a microscope and a diamond scribe, Jacomini, divided the gear into 1440 equal segments, one for each tooth, scribing the marks on an inserted brass ring near the edge of the gear. Later he gashed the teeth individually. The gear and worm were "run in" with rouge and oil.

The rotating 100-foot, 500-ton double skin dome is similar to that found in the 60-inch telescope. The dome is supported by railroad trucks on a precision-ground double circular railroad track and is controlled by electric motors.

In 1981 the 100-inch Hooker reflector was designated an International Historic Mechanical Engineering Landmark by the American Society of Mechanical Engineers. In 1985, due to the lack of operating funds, the Carnegie Institution mothballed the Hooker reflector.

Other Features

In addition to the five major telescopes described above, there are multiple reflectors, refractors and cameras housed in smaller domes around the mountain. There are also many support facilities including garages, warehouses, water tanks, individual houses and dormitories on the mountain. Only the five major telescopes described in this nomination contribute to the national significance of the Mount Wilson Observatory.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

nationally statewide locally

Applicable National Register Criteria A B C D NHL Criteria 1,2

Criteria Considerations (Exceptions) A B C D E F G

Areas of Significance (enter categories from instructions)

National Register Significance
Education, Engineering, Science
National Historic Landmark: Science
Subtheme: Physical Science, Facet:
Astronomy

Period of Significance

1904

Significant Dates

1904-Present

Cultural Affiliation

Significant Person

George Ellery Hale

Architect/Builder

George Ellery Hale

Edwin Hubble

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

Summary

The establishment of the Mount Wilson Observatory in 1904, by American astronomer George Ellery Hale, brought a new era to the science of astronomy. The Snow horizontal telescope and the two solar tower telescopes were the first major instruments placed on Mount Wilson. Completion of the 60-inch reflector in 1908 and the 100-inch Hooker reflector in 1917 made Mount Wilson the home of the two largest telescopes in existence and the center of the astronomical world. These telescopes represented a quantum leap in mechanical and optical engineering capability. They laid the technological foundation for all large modern telescopes. Many of the major advances and greatest names in 20th-century astronomy are associated with the Mount Wilson Observatory, including Edwin P. Hubble, who in 1929 used the 100-inch Hooker reflector to gather data that showed the universe to be in a regular state of expansion thereby providing the first clues to the origin of the universe. ²

History

The decision of the Carnegie Institution of Washington, DC, to build the Mount Wilson Solar Observatory in the San Gabriel Mountains near Los Angeles was made at the urging of Dr. George Ellery Hale, the organizer and director of the Yerkes observatory at William's Bay, Wisconsin.

The first permanent telescope on Mount Wilson was the Snow horizontal solar telescope that Hale brought from the Yerkes observatory in 1904. The Snow telescope was followed by the 60-foot solar telescope in 1907 and the 60-inch reflector, for deep sky observations, in 1908. In 1912 Hale added the 150-foot solar telescope and in 1917 the 100-inch Hooker reflector. In 1920, after the completion of the 100-inch Hooker reflector, the Carnegie Institution, changed the name of the observatory from the Mount Wilson Solar Observatory to the Mount Wilson Observatory.

See continuation sheet

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Hale, who was appointed the director of Mount Wilson in 1904 long dreamed of establishing a mountaintop observatory that would combine a solar telescope and a large reflecting telescope. Hale's experience at Yerkes, with its large 40-inch refractor, convinced him that the future of astronomy resided with the large reflecting telescope that would prove a suitable instrument for the study of astrophysics--the application of the principles of physics to astronomical objects beyond the earth. He justified the combination of a solar observatory with a large reflecting telescope, designed for stellar astronomy, when he wrote: "The story of the origin of the sun and its development is illustrated in stars of many types which are no less important to a thorough understanding of its physical constitution than is a direct investigation of solar phenomena."

At Mount Wilson, Hale would put his theory of the modern observatory into practice. The Mount Wilson Observatory soon set the style for modern observatories. Whereas Yerkes was built on the traditional pattern of an imposing central building with domes for the various telescopes and separate houses for staff on the grounds, at Mount Wilson Hale built only the observing instruments and a "monastery" with temporary accommodations for the staff actually engaged in observing. The staff lived in Pasadena, where the headquarters of the observatory was located.

The concentration of these modern instruments and the favorable location of the observatory on a high mountain with clear skies soon attracted the most famous astronomers in the world to work with and use these telescopes. Hale encouraged this practice by helping many of them secure funds from the Carnegie Institution through its Research Associate Program. These astronomers included Jacobus Kapteyn from the Netherlands, Ejnar Hertzsprung from Germany, Bertil Lindblad from Sweden, and Jan Oort from the Netherlands. Among the famous American astronomers who came to Mount Wilson were Edward Emerson Barnard from the Lick Observatory, Albert Michelson from the University of Chicago, Henry Norris Russell from Princeton University, and Joel Stebbins from the University of Wisconsin.

The success of the Mount Wilson telescopes was soon spread through the influence of these men to the wider astronomical community and led to the construction of a whole new series of big reflectors between the two World Wars. While no one telescope was as large as the 100-inch Hooker reflector, many smaller reflectors were built using many of the design principles first tested at Mount Wilson.

Perhaps the most famous instrument at Mount Wilson was the 100-inch Hooker reflector, which from 1919 until it was moth-balled in 1985, never ceased to make significant contributions to the science of astronomy.

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The 100-inch Hooker reflector was responsible for the first detailed photographs of "spiral nebulae." According to an early estimate by Hale, the Hooker reflector could photograph at least two million nebulae. In addition, these photographs not only showed structure, but they also showed fainter stars than anyone had seen before. Astronomer Edwin P. Hubble's detection of the first Cepheid variable star in the Andromeda Galaxy in 1923 ended all arguments on the nature of the spirals. This discovery provided positive proof that the spiral nebulae were each a stellar system, external to our own galaxy, the Milky Way. Later, Hubble and his assistant Milton Humason, as a result of their observations with the Hooker reflector, discovered that most galaxies were moving at high speeds away from the Earth. Using these observations, Hubble showed that the universe expands according to the following law: The greater the galaxy's distance from us, the greater its velocity, in direct proportion. This means that a galaxy twice as far from us as another is receding twice as fast. Hubble soon realized that such an expansion has two curious properties. First, every galaxy appears to be the center of the expansion as seen from that particular galaxy. Second, at one time in the distant past, all the matter in the universe must have been collected together at one place and time. Hubble's observations pointed clearly to a beginning. Here for the first time was direct evidence for a unique creation event, what cosmologists call the "Big Bang" theory.

Another important visitor to Mount Wilson was the Nobel Prize-winning physicist Albert Michelson, of the University of Chicago, who came to the observatory in 1919 and returned frequently as a guest investigator. In historic experiments on Mount Wilson in the 1920s, Michelson accurately measured the speed of light. Michelson mounted a rotating octagonal mirror on Mount Wilson, and used it to reflect a beam of light to a flat mirror mounted on nearby Mount Baldy. The Mount Baldy mirror in turn reflected the beam back to another facet of the spinning mirror on Mount Wilson, where it was reflected to the observer's eye. By adjusting the rotation speed so that the 8-sided mirror would make exactly 1/8th of a turn as the light traveled from Mount Wilson to Mount Baldy and back, Michelson measured the speed of light with great accuracy.

Michelson also used the 100-inch Hooker reflector to advantage. He developed an instrument called the stellar interferometer, a device for use on a telescope to allow the measurement of very small distances in the sky. With extra mirrors mounted on a 20-foot beam attached to the top of the Hooker reflector, Michelson made the first direct measurements of the sizes of stars other than the sun. In 1920, for example, Michelson determined the diameter of the star Betelgeuse to be 215,000,000 miles, a huge distance compared to that of our own sun. Other stellar diameters were measured, and they were able to prove the validity of astronomer Henry Norris Russell's theory of red super-giant stars.

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Section number 8 Page 4

For most of this century the Mount Wilson Observatory and its major telescopes have contributed mightily to our understanding of the science of astronomy and the universe we inhabit. Within a few years after the observatory was begun, five of the world's great telescopes, including the world's largest solar and stellar telescopes, were in operation on the mountain. Many fundamental problems in astronomy--the nature of sunspots, the temperature and composition of stars, the structure of the universe, and the most basic questions of all involving the very origin of the universe were addressed by the greatest astronomers in the world using the best equipment money could buy. George Ellery Hale's conception of the modern observatory was vindicated. The Mount Wilson model had forever changed the history of the science of astronomy.

United States Department of the Interior
National Park ServiceNational Register of Historic Places
Continuation SheetSection number 8 Page 5Footnotes

1. The descriptive material in this section was taken from the following sources.

Helen Wright, Explorer of the Universe: A Biography of George Ellery Hale (New York: E.P. Dutton & Co., Inc. 1966), pp. 207-209.

Michael Simmons, "Reflections on Mount Wilson's Past: Building the 100-inch Telescope," Reflections from the Mount Wilson Observatory Association, Fall 1986, pp. 1, 12-16.

Owen Gingerich, ed., Astrophysics and twentieth century astronomy to 1950 (Cambridge, England: Cambridge University Press, 1984), IV: 137-44.

Richard Learner, Astronomy Through the Telescope (New York: Van Nostrand Reinhold Company, 1981), p. 112.

The American Society of Mechanical Engineers, The 100-Inch Telescope of the Mount Wilson Observatory (Northrop Corporation, 1981). (Brochure)

2. The historical background for this section was taken from the following sources:

Gingerich, op. cit., pp. 137-144

Mount Wilson Institute, The Mount Wilson Observatory: A View Toward the Future, Draft Proposal, October 1987.

Allan Sandage, "Inventing the Beginning," Science 84, November 1984, pp. 111-113.

Siegfried Marx and Werner Pfau, Observatories of the World (New York: Van Nostrand Reinhold Company, 1984), pp. 115-119.

Simmons, op. cit., pp. 14-16.

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National Park Service

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Continuation Sheet

Section number 9 Page 2

Bibliography

Abell, George O. Exploration of the Universe. 4th ed., Philadelphia: Saunders College Publishing, 1982.

American Society for Mechanical Engineers. The 100-inch Telescope of the Mount Wilson Observatory. Northrop Corporation, 1981. (Brochure)

Asimov, Isaac. Eyes On The Universe. Boston: Houghton Mifflin Company, 1975.

Gingerich, Owen, ed. Astrophysics and twentieth century astronomy to 1950. Cambridge, England: Cambridge University Press, 1984.

Kirby-Smith, H.T. U.S. Observatories: A Directory and Travel Guide. New York: Van Nostrand Reinhold Company, 1976.

Learner, Richard. Astronomy Through the Telescope. New York: Van Nostrand Reinhold Company, 1981.

Marx, Siegfried, and Werner Pfau. Observatories of the World. New York: Van Nostrand Reinhold Company, 1984.

Mount Wilson Institute. The Mount Wilson Observatory: A View Towards Its Future. Draft Proposal, 1987.

Mount Wilson Observatory Association. "Mount Wilson Observatory: A Self-Guided Walking Tour." no date.

Sandage, Allan. "Inventing the Beginning." Science 84, November 1984, pp. 111-113.

Simmons, Michael. "Reflections on Mount Wilson's Past: Building the 100-inch Telescope" Reflections from the Mount Wilson Institute, Fall 1986, pp. 1, 12-16.

Wright, Helen. Explorer of the Universe: A Biography of George Ellery Hale. New York: E. P. Dutton & Co., Inc., 1966.

9. Major Bibliographical References

See Continuation Sheet

Previous documentation on file (NPS):

- preliminary determination of individual listing (36 CFR 67) has been requested
- previously listed in the National Register
- previously determined eligible by the National Register
- designated a National Historic Landmark
- recorded by Historic American Buildings Survey # _____
- recorded by Historic American Engineering Record # _____

See continuation sheet

Primary location of additional data:

- State historic preservation office
- Other State agency
- Federal agency
- Local government
- University
- Other

Specify repository: _____

10. Geographical Data

Acres of property 1,050

UTM References

A

1	1	4	0	3	0	0	0	3	7	8	7	3	6	0
Zone	Easting		Northing											

B

1	1	4	0	2	9	2	0	3	7	8	7	1	2	0
Zone	Easting		Northing											

C

1	1	4	0	2	7	2	0	3	7	8	6	9	2	0
Zone	Easting		Northing											

D

1	1	4	0	2	4	4	0	3	7	8	7	2	4	0
Zone	Easting		Northing											

E. 11/402720/3787680

See continuation sheet

Verbal Boundary Description

The boundary follows the outside perimeter of the 1,050 acre plateau at the summit of Mt. Hamilton.

See continuation sheet

Boundary Justification

The boundary includes all of the historic resources of the Mt. Wilson Observatory that contribute to the national significance of the site.

See continuation sheet

11. Form Prepared By

name/title Harry Butowsky date May 1, 1989
 organization National Park Service telephone (202) 343-8155
 street & number 1100 L Street, N.W. state DC zip code 20013
 city or town Washington

LIST OF BUILDINGS AT MT. WILSON OBS.

- 100-INCH DOME: Built in 1918, contains historic 100-inch telescope and aluminizing facilities.
- 60- INCH DOME: Built in 1907, contains 60-inch telescope which was the first large stellar telescope on Mt. Wilson.
- 150-FOOT SOLAR TOWER: Tower containing 12-inch refracting solar telescope. Built in 1910.
- 60-FOOT SOLAR TOWER: Built in 1907, solar telescope where George Hale discovered magnetic fields in sunspots. Contains 12-inch refractor.
- SNOW TELESCOPE: Built with funding from Helen Snow and brought to Mt. Wilson in 1904, this was the first permanent telescope of the Carnegie Institution. Contains 60-foot reflecting solar telescope of 24 inches aperture. Although used primarily for solar work, it has been operated historically for stellar spectroscopy by W.S.Adams.
- 10-FOOT SOLAR TELESCOPE: Small solar distortion telescope operated by Caltech.
- 6-INCH DOME: Contains 6-inch Cooke refractor on a Warner Swasey mount. Used now as a visitor's viewing telescope. It has, in the past, been utilized many times as a test bench for experimental optics by the staff astronomers at Mt. Wilson.
- 24-INCH DOME: Empty now, has contained many telescopes over the years. Most recently housed Caltech 24-inch reflector.
- NRL INTERFEROMETER: Recent interferometer designed and operated by Dr. Michael Shao, (et al).
- UC INTERFEROMETER: Two trailer telescopes designed and operated by Dr. Charles Townes, (et al).
- OBSERVATORY OFFICE: Built in the 20's, this building housed the 50-foot Michelson - Pease interferometer until 1979 when it was dismantled to make room for observatory office/carpentry shop/electronics lab.
- LIBRARY: Mountain working library and transient office space. Also contains billiards room and spare darkroom/plate baking room. During the early days of the observatory, this was the mountain physical laboratory where many experiments were carried out by Hale, Gale, King, and H.D. Babcock.

MACHINE SHOP: Mtn. machine shop. Also contains emergency AC-DC power generators. North end is hardware room.

AC GENERATOR SHED: Small building housing on-line navy surplus 110 VAC generator.

BATTERY ROOM: Located below and west of the machine shop, it was used as room for lead-acid batteries in early days. Now used for storage.

SMALL ROOM: Small 1 room building of unknown use and origin. Located next to and northwest of the library.

PLATE VAULT: Located under 60-foot tower, has been used in the past as a storage room for unexposed photographic plates; now empty.

SEISMOMETER HOUSE: Small wooden building containing Caltech/PCC seismographs.

MAGNETOMETER HOUSE: Very small wooden building, now empty, which at one time housed Carnegie magnetometers. Discontinued about the time of the arrival of TV stations (and TVI) on mtn.

MUSEUM-AUDITORIUM: Carnegie museum of astronomical photographs and scale model of observatory. North end contains 256 seat auditorium which was the location of friday night lectures that were discontinued in 1942. Has the only public accessible restrooms on observatory property.

MONASTERY: Sixteen room dormitory built in 1909, used as sleeping accomodations for visiting astronomers and guests. Has adjoining sitting room and dining hall. Adjacent is kitchen and rooms for cook/steward.

GARAGES: Housing for snow plow and skip loader. Storage for hand tools. Three sets of garages for mtn. employees large enough to hold 13 autos, total.

FIRE PUMP ROOMS: Two buildings, one having a gasoline, and one having an electric, fire pump. Both feed into a manifold which is the basis for mtn. fire fighting system.

WATER TANKS: Three water tanks of about 670,000 gallon combined capacity used for both mtn. potable supply and fire fighting.

PUMP HOUSES: Two water wells and associated pump houses located about ¼ mile down a north canyon. Source for mountain water supply.

POWER DISTRIBUTION SHED: Small building south of 60" which contains AC circuit breakers for all facilities.

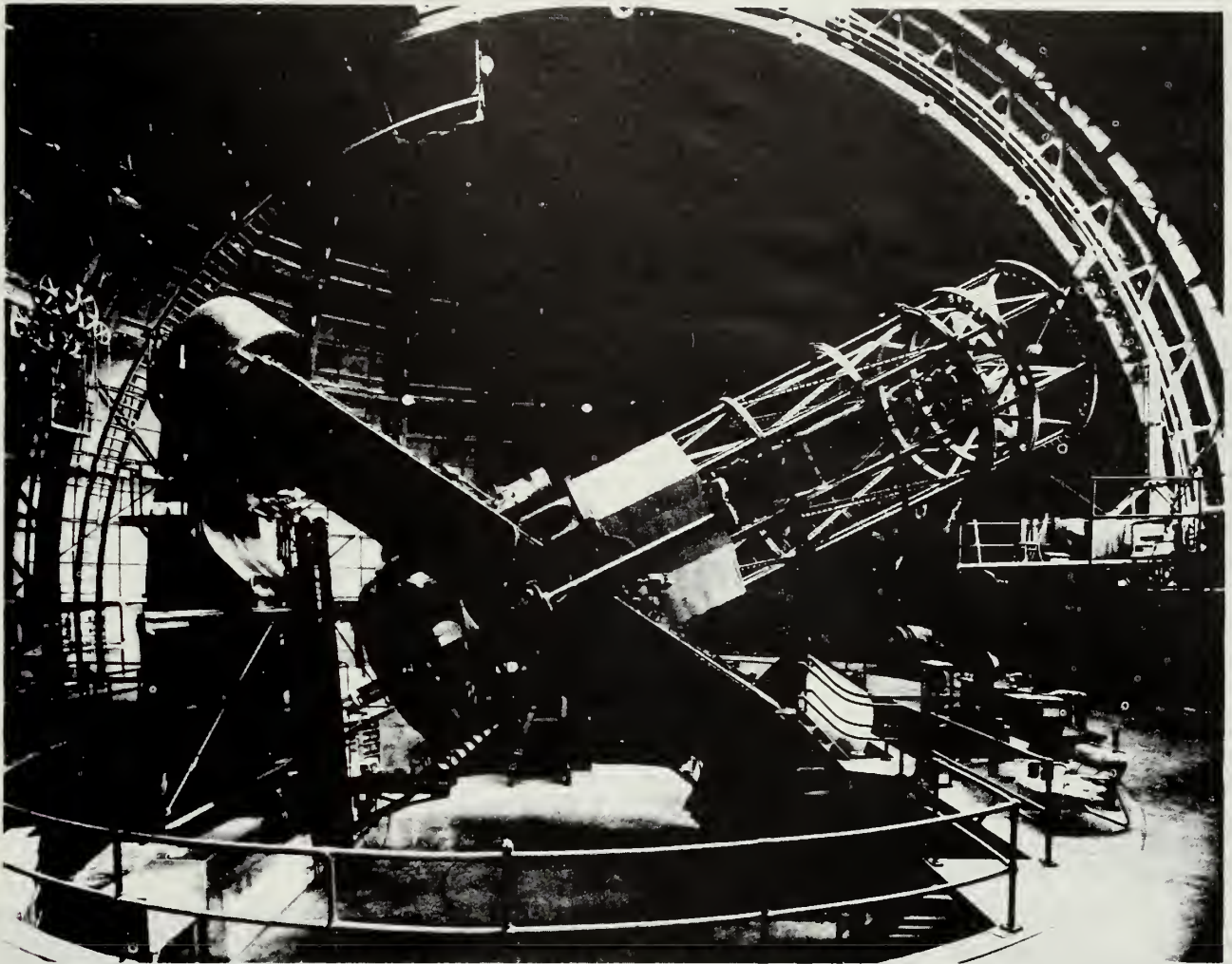
ASTROGRAPH SHED: Now converted to a studio, was used as housing for astrograph in early days.

KAPETYN COTTAGE 1 bedroom vacation cottage available to Carnegie employees.

HOTEL CABIN: Last remaining cabin of Mt. Wilson Hotel. 1 room and in very poor shape.

CABIN #1: 4 bedroom employee housing.
CABIN #2: 3 bedroom employee housing.
CABIN #3: 2 bedroom employee housing.
CABIN #4: 3 bedroom employee housing.
CABIN #6: 2 bedroom employee housing.
CABIN #7: 3 bedroom employee housing.
CABIN #8: 1 bedroom employee housing.
CABIN #9: 1 bedroom employee housing.
CABIN #16: 1 bedroom employee housing.

L. Webster 27-Jan-88



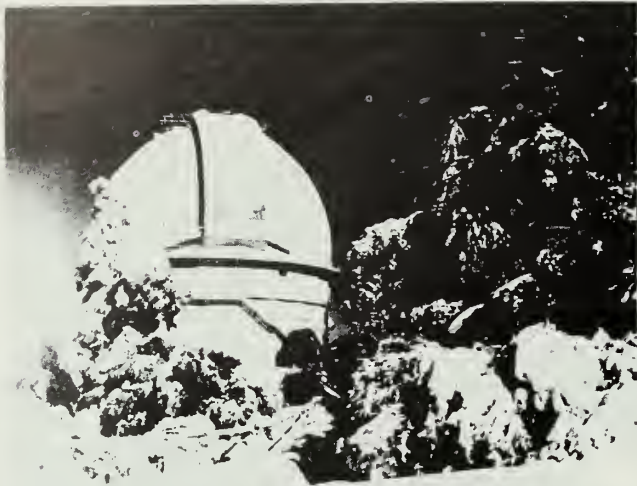
The 100 - Inch Telescope of the Mount Wilson Observatory



An International Historical Mechanical
Engineering Landmark

The American Society of Mechanical
Engineers • June 20, 1981

Mount Wilson Observatory
Mount Wilson, California



The completed facility.

SCIENTIFIC ACHIEVEMENTS

The Mount Wilson 100-inch reflector dominated discoveries in astronomy from its beginning in 1918 until the dedication of the Palomar 200-inch reflector in 1948. (Both telescopes are primarily the result of the lifework of one man — George Ellery Hale.) Many of the foundations of modern astrophysics were set down by work with this telescope.

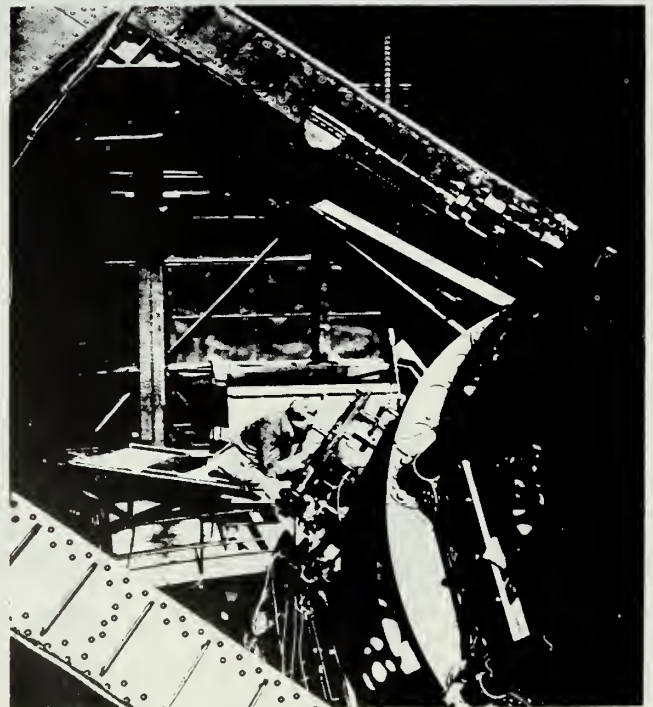
One of the most important results was the discovery that the intrinsic luminosities (total light output) of the stars could be found by inspection of the record made when starlight is dispersed into a spectrum by a prism or a grating. These so-called spectroscopic absolute luminosities, discovered at Mount Wilson and developed for over forty years, opened the way to an understanding of the evolution of the stars and eventually to their ages.

Perhaps the most important scientific discovery of the 20th century is that we live in an expanding Universe. The observed velocities of galaxies increase progressively with ever-increasing distances. It was this finding, made in 1929 with the Hooker reflector, together with the earlier discovery in 1924, also made with the Hooker reflector, that galaxies are stellar systems, that solved the most basic question of cosmology — namely, what is the nature of the large scale structure of the Universe.

BACKGROUND

THE MOUNT WILSON OBSERVATORY was founded in 1904 by the CARNEGIE INSTITUTION OF WASHINGTON, a private foundation for scientific research supported largely from endowments provided by Andrew Carnegie.

Within a few years, the Observatory became the world center of research in the new science of astrophysics, which is the application of principles of physics to astronomical objects beyond the earth. These include the sun, the planets of our solar system, the stars in our galaxy, and the system of galaxies that reaches to the limits of the visible universe.



Francis G. Pease at the Cassegrain focus of the 100-inch telescope.

1910–1918. DESIGN AND CONSTRUCTION OF THE MOUNT WILSON 100-INCH HOOKER TELESCOPE

In 1902, George Ellery Hale, builder and first director of the University of Chicago's Yerkes Observatory, proposed and persuaded the Institution that an observatory be started in the California wilderness above Pasadena to study the sun and stars from a mountain site. Soon after, Hale assembled the nucleus of a group of astronomers, engineers, and technicians who designed and constructed the Mount Wilson telescopes to new standards of excellence and performance. The first facilities to be built were the 60-foot and 150-foot solar towers and the 60-inch reflector.

Hale began planning the 100-inch telescope project as early as 1906. In that year a gift of \$45,000 from Mr. John Hooker of Los Angeles permitted placing the order for the 4½-ton glass disk for the mirror with the Plate Glass Company of St. Gobain in France. After initial failures a successful casting produced the largest glass blank then in existence. The disk was received in Pasadena in 1908.

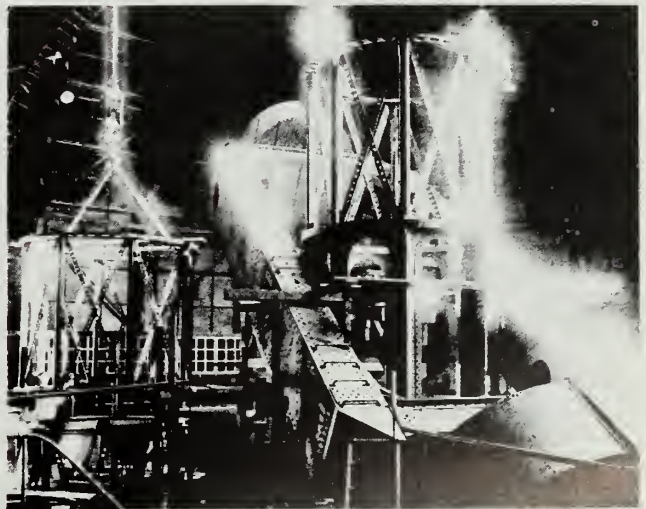
Design and construction of the 100-inch telescope took place during the years 1910-1918. Francis G. Pease (see photo) was the chief designer and a trained mechanical engineer. He was responsible for mechanical engineering, design calculations, material selection, and performance specifications of the 100-inch telescope. Major engineering problems had to be solved. One was that of supporting the massive mirror with no final stress that would distort its surface in all positions of gravity loading, as the telescope moves to follow the stars. Another was the compensation for flexure of the tube that carries the secondary mirrors and photographic equipment so that the axis of the optical train remains nearly stationary relative to the tube. As the structure is very large, these problems of support were of great concern. While the massive and intricate support and mounting mechanisms were being designed, the mirror itself was being ground to a precise figure in the Observatory's optical shop, under the direction of G.W. Ritchey. The new techniques of optical engineering invented here were later used in all other telescopes built after 1920.

The larger and heavier parts of the telescope were constructed at the Fore River Shipyards in Quincy, MA, where Professor Peter Schwamb of M.I.T. was resident representative of the Observatory. The dome was designed by D. H. Burnham & Co. of Chicago; it was erected by the Morava Construction Co.



The road over which the telescope and dome structures were hauled to Mount Wilson.

Transport of the telescope and dome structures from Pasadena to the mountaintop was itself a challenge. The 9-mile road previously carved out of the rugged slopes of the San Gabriel mountains had to be widened. A special truck was constructed; in the end, mules had to help.



Assembly of the telescope in its dome.

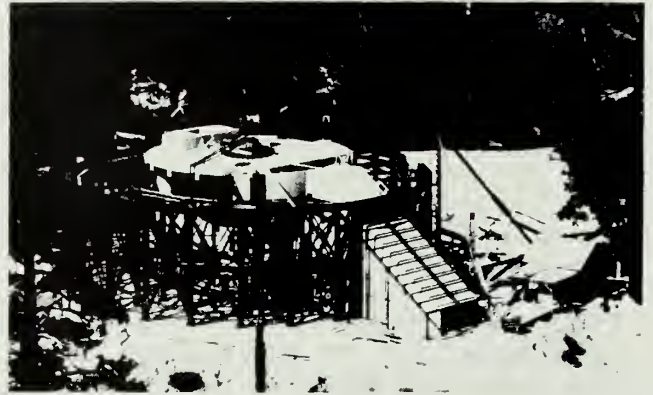
NOTEWORTHY DESIGN FEATURES

Among the noteworthy features is the use of *mercury flotation* for reduction of friction. (This was earlier used for the first time on the Mount Wilson 60-inch telescope.) The polar axle of the telescope, on which the 87-ton instrument must turn smoothly to counteract the rotation of the earth, is defined by self-aligning journal bearings, but the bulk of the load is carried by two steel drums that float in mercury. The resulting friction is so low that the whole telescope may be rotated by the force exerted by one hand at the end of the main tube.

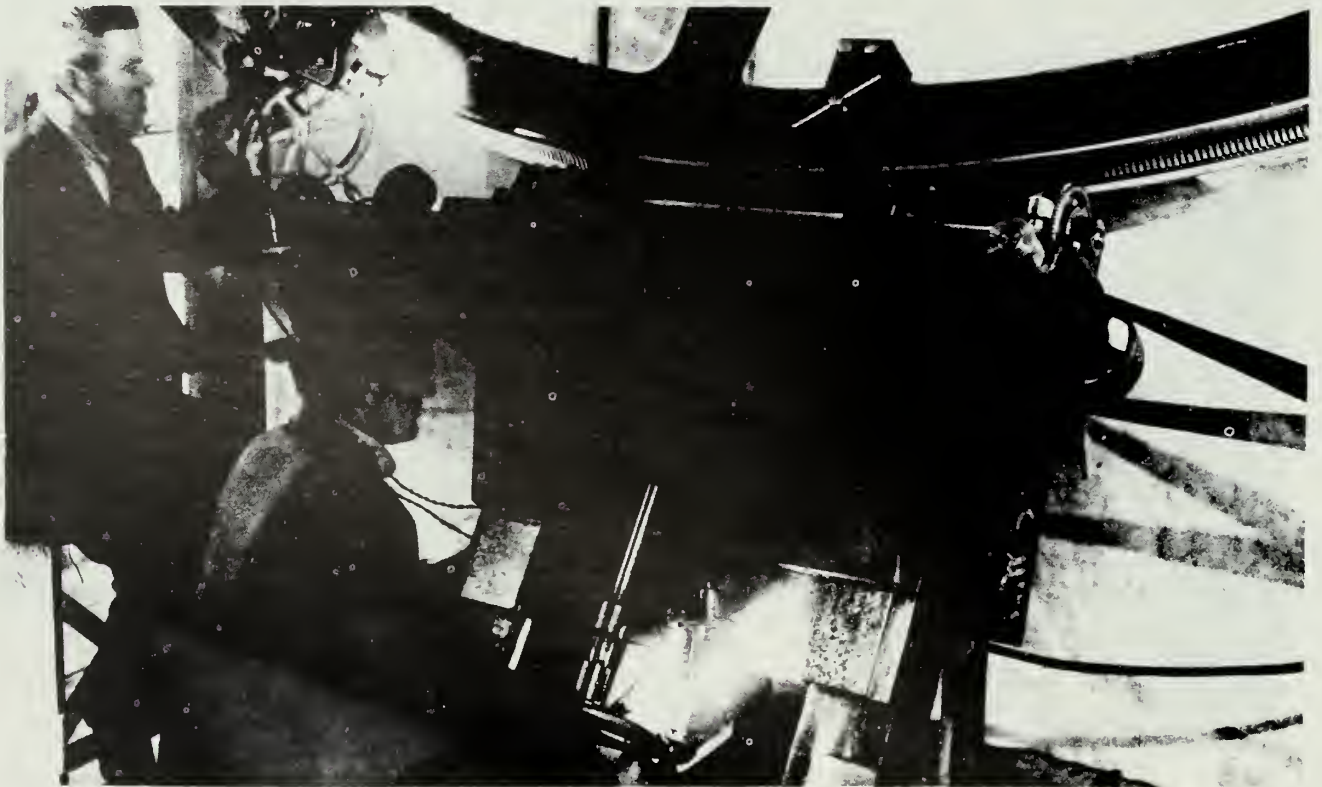
To rotate the telescope at the sidereal rate, a large worm gear, 18 feet in diameter, is mounted on the south end of the polar axle. The gear, of cast iron with hollow spokes, was made in two halves, bolted together along a diameter. It meshes with a tool-steel worm that is rotated by a mechanical driving clock at one turn per minute. Because tracking errors greater than one-tenth arc-second cannot be tolerated, great precision was required in cutting the teeth of the large worm gear. This operation was done by the Italian instrument maker, C. Jacomini, with the gear in place on the telescope. Using a microscope and a diamond scribe, he first divided the gear into 1440 equal segments, one for each tooth, scribing the marks on an inserted brass ring near the edge of the gear. Later he gashed the teeth individually. The gear and worm were "run in" with

rouge and oil. The worm is driven by a governor-controlled, weight-driven mechanical clock that was constructed in the Observatory's shop.

The *rotating dome* placed over the telescope (which weighs 500 tons) was also of innovative design in its mechanical structure and electric control. The dome, supported by railroad trucks on a precision-ground double, circular railroad track, must rotate smoothly to keep the open dome slit in the telescope's direction. The mechanism, under control of the astronomer, must respond quickly to his command no matter at which of the possible observing stations he may be working.



Grinding the rails for the moving dome.



Gashing of one of the 1440 teeth in the 18-foot diameter gear.

PLAQUE WORDING

INTERNATIONAL HISTORIC MECHANICAL ENGINEERING LANDMARK

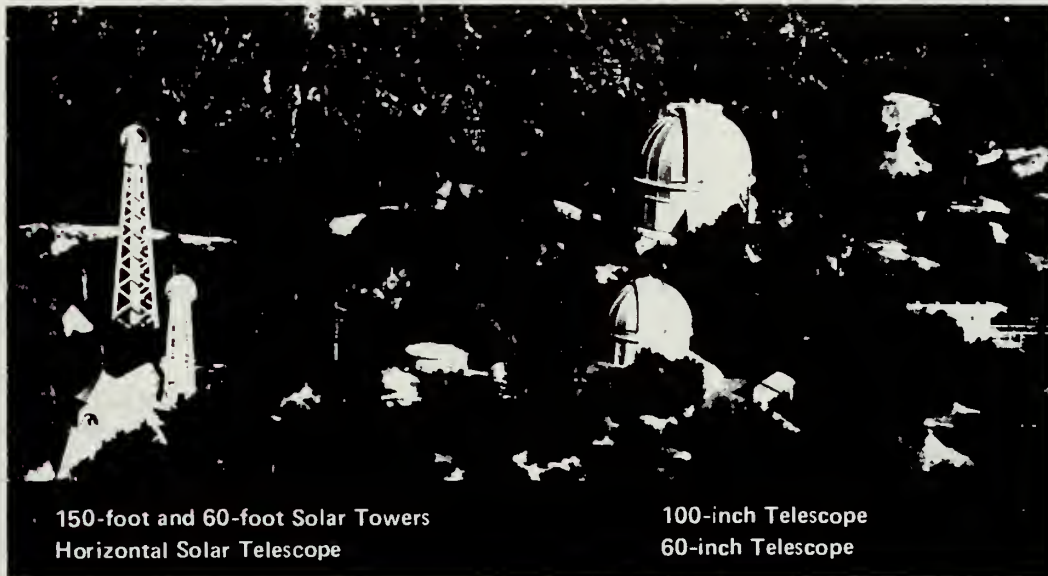
The Mount Wilson 100-inch Telescope – 1918

The increased light-grasp of this telescope made possible many notable advances in structural cosmology between 1924 and 1930. They have revised our ideas about the universe in which we live.

One of these advances was that the spiral nebulae are galactic units like our own; another was the idea of an expanding universe.

The telescope's mirror support and the use of mercury flotation to reduce the friction are among its outstanding engineering features.

The American Society of Mechanical Engineers – 1981



150-foot and 60-foot Solar Towers
Horizontal Solar Telescope

100-inch Telescope
60-inch Telescope

Aerial view of the Mount Wilson Observatory

AN ACCOLADE

The Mount Wilson 100-inch reflector telescope is an engineering marvel whose role in the development of astronomy is unique among scientific instruments. Its past achievements are legend, and, given its age, it is even more remarkable that it is still in regular nighttime operation, serving still another generation of staff and guest observers.

*1918-1981, 63 years of
constant service*



*The western loop of Veil Nebula in Cygnus (taken with the
100-inch telescope).*

ACKNOWLEDGEMENTS

The Los Angeles Section of the American Society of Mechanical Engineers acknowledges the efforts of those members who organized the landmark dedication program. The Los Angeles Section also recognizes the efforts and cooperation of the Carnegie Institution of Washington and the Mount Wilson Observatory.

The American Society of Mechanical Engineers

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Dr. Charles E. Jones, *Past President*
Richard K. Pefley, *Vice President, ASME Region IX*
Bill Adams, *Chairman, ASME Region IX*
History and Heritage Committee
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NATIONAL HISTORIC MECHANICAL ENGINEERING LANDMARK PROGRAM

In September 1971, the ASME Council reactivated the Society's History and Heritage program with the formation of a National History and Heritage Committee. The overall objective of the committee is to promote a general awareness of our technical heritage among both engineers and the general public. A charge given the committee is to gather data on all works and artifacts with a mechanical engineering connection which are historically significant to the profession — an ambitious goal, and one achieved largely through the volunteer efforts of the Sections and Divisions History and Heritage Committees and interested ASME members.

Accordingly, two major programs are carried out by the Sections and Divisions under the direction of the National Committee: 1) a listing of industrial operations and related mechanical engineering artifacts in local Historic Engineering Records; and 2) a National Historic Mechanical Engineering Landmark program. The former is a record of detailed studies of sites in each local area; the latter is a de-

marcation of local sites which are of national significance — people or events which have contributed to the general development of civilization.

In addition, the Society cooperates with the Smithsonian Institution in a joint project which provides contributions of historical material to the National Museum of History and Technology in Washington, D.C. The Institution's permanent exhibition of mechanical engineering memorabilia is under the direction of a curator, who also serves as an ex-officio member of the ASME National History and Heritage Committee.

The Mount Wilson 100-inch Telescope is the fifty-ninth landmark and fourth international landmark to be designated since the program began in 1973.

For a complete list of the Society's landmarks, please contact the Public Information Department, ASME Headquarters, 345 E. 47th Street, New York, N.Y. 10017 212/644-7740.

The Mount Wilson Observatory is located in the mountains northeast of Pasadena, CA. Offices, shops, laboratories, and research facilities are at 813 Santa Barbara St., Pasadena, CA 91101, 213/577-1122. The observatory is one of five research departments operated by the CARNEGIE INSTITUTION OF WASHINGTON.

THIS BROCHURE WAS PRODUCED BY NORTHROP CORPORATION

THE MOUNT WILSON OBSERVATORY

was founded in 1904 by the Carnegie Institution of Washington, a private foundation for scientific research supported largely from endowments provided by Andrew Carnegie. The Observatory is operated jointly with the Palomar Observatory of the California Institute of Technology. Both Observatories are primarily the result of the lifework of one man, the astronomer George Ellery Hale.

Mount Wilson — elevation 5,713 feet — was chosen as the site of the Observatory because of its excellent atmospheric conditions and easy accessibility from Pasadena.

Large modern TELESCOPES are designed for photographic and photoelectric recording. The photographic plate and phototube are better detectors than the eye and provide permanent records of astronomical observations to which astronomers may refer at any later time. Consequently, instead of looking through a telescope at celestial bodies, the astronomer uses his telescope as a recording instrument. The photographic and photoelectric records are measured and studied at the Pasadena offices in order to determine the positions, distances, brightness, temperatures, and chemical composition of stars, nebulae, and galaxies.

Among the instruments on Mount Wilson are the 60-inch and 100-inch reflecting telescopes, huge cameras constructed on the same general principles as a hand camera except that a large concave mirror takes the place of the lens.

Also available are the 60-foot and 150-foot tower telescopes that are long-focus cameras specifically designed to photograph the sun.

STELLAR TELESCOPES 100-INCH HOOKER TELESCOPE

The mirror in the Hooker telescope is a glass disk 100 inches in diameter, 13 inches thick, weighing 4½ tons, located at the bottom end of the telescope tube.

Its front surface is concave and coated with a very thin, brilliant film of aluminum. Such a mirror focuses starlight to an image that is sharper and brighter than that produced by a telescope lens. The glass disk for the 100-inch mirror was cast at Saint-Gobain in France before World War I. It required six years of grinding and polishing in the Pasadena optical shop before it was moved to Mt. Wilson in 1918.

For thirty years the Hooker telescope was the largest in the world. Proof that our Milky Way System is only one of millions of galaxies, each made up of billions of stars, and that the universe is enormously larger than had previously been supposed, came from observations made during its first decade of operation. The success of the 100-inch telescope in solving these and dozens of other important problems provided the main incentive for the construction of a still larger instrument, the 200-inch Hale telescope on Palomar Mountain.



THE 100-INCH HOOKER TELESCOPE AS SEEN FROM THE WEST SIDE



60 INCH TELESCOPE

60-INCH TELESCOPE

The 60-inch telescope was completed in 1908 and was for a time the largest instrument of its kind in the world. Although outclassed by the 100-inch and 200-inch telescopes, and others belonging to various observatories around the world, it is still a very powerful and productive instrument.

SOLAR TELESCOPES

HORIZONTAL SOLAR TELESCOPE

The long building situated near the base of the small solar tower telescope houses the first astronomical instrument constructed on Mt. Wilson. All parts of this solar telescope were hauled up the mountain trail by mules because of lack of roads and motor transportation. It proved so successful that plans were made to improve its principles of operation still further by constructing the tower telescopes that would take the sun's light from high above the ground and its disturbing heat waves.



150 FOOT
SOLAR TOWER TELESCOPE

150 FOOT SOLAR TOWER TELESCOPE

The larger of the two sun tower telescopes is nearly 170 feet in total height. Sunlight is reflected down the central shaft by two mirrors in the dome at the top. One of these mirrors is slowly turned by a clockwork to follow the motion of the sun. These mirrors reflect the light vertically downward through a 12-inch diameter lens of 150-foot focal length that forms an image of the sun about 17 inches in diameter in the observation room at ground level.

60-FOOT SOLAR TOWER TELESCOPE

The first of the tower telescopes, the 60-foot instrument amply justified the innovation in design of such instruments. Every clear day its intricate equipment photographs the sun in light of various colors, recording great solar storms, sunspots, and other phenomena, some of which affect the weather and radio reception on earth.

ADDITIONAL INFORMATION

concerning the instruments and work of the Observatory can be found in the publication **FRONTIERS IN SPACE**, available from the Bookstore of the California Institute of Technology, 1201 East California Blvd., Pasadena, California 91109.

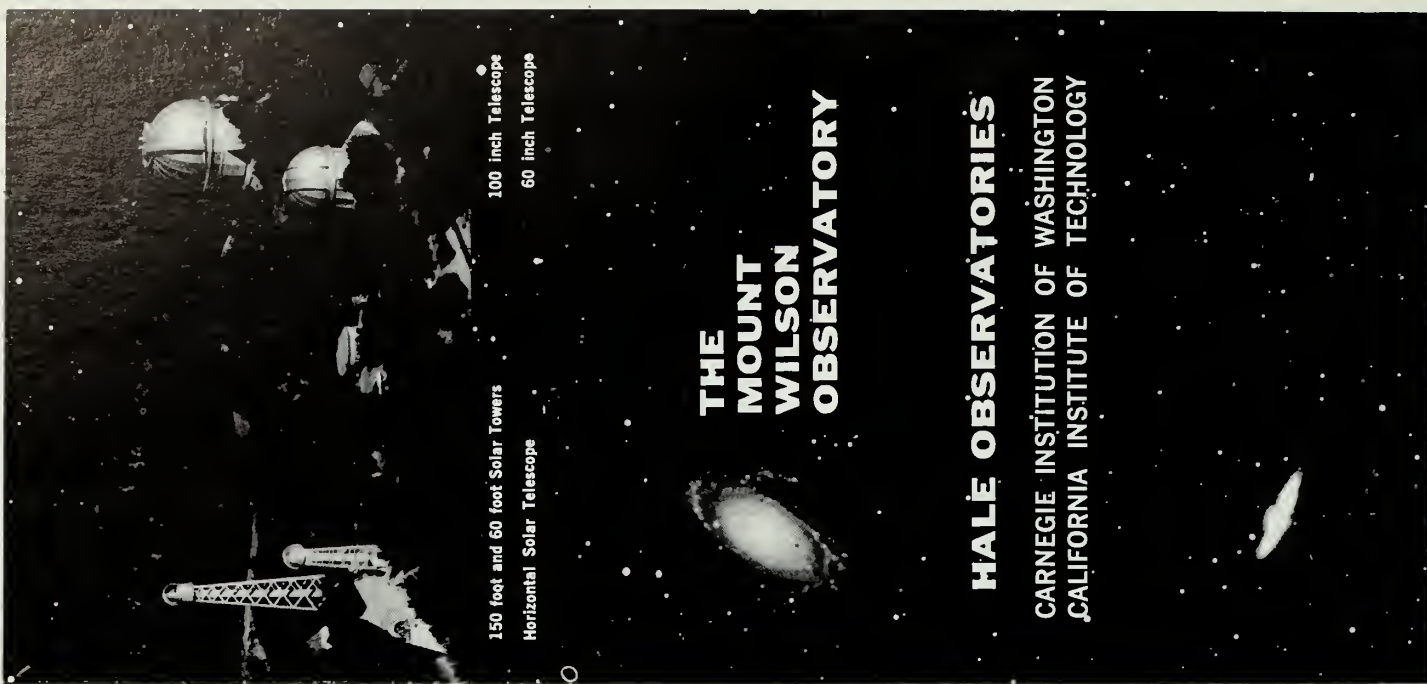
VISITORS

The 100-inch telescope may be viewed from a visitors' gallery in the dome. In the exhibit hall across the road from the large solar tower is a group of representative photographs of the sun, moon, planets, comets, nebulae, and galaxies. Both the visitors' gallery and exhibit hall are open from 10:00 A.M. to 5:00 P.M. daily. They are closed Christmas Day. The grounds of the Observatory are closed at night.

No admission charge is made by the Observatory. However, the instruments are located on land leased from private owners who collect a fee for parking and the use of their other facilities. The Observatory does not benefit from the collection of this fee.

Since the Observatory's instruments are primarily cameras, they are not available for visual observations by visitors. For those who wish to look at the moon, planets, or other objects, the following facility, specifically designed for visual observations and supported by public funds, is recommended:

GRIFFITH OBSERVATORY, located in Griffith Park, Los Angeles; telephone 664-1191. P. O. Box 27787, Los Feliz Station, Los Angeles, California 90027. A 12-inch telescope, Zeiss planetarium, and a Hall of Science are open to the public Tuesday through Sunday. Lectures accompany the Planetarium shows and an operating model of the 200-inch Hale telescope at Palomar may be seen in the Hall of Science. For further information write to the Griffith Observatory.



150 foot and 60 foot Solar Towers
Horizontal Solar Telescope

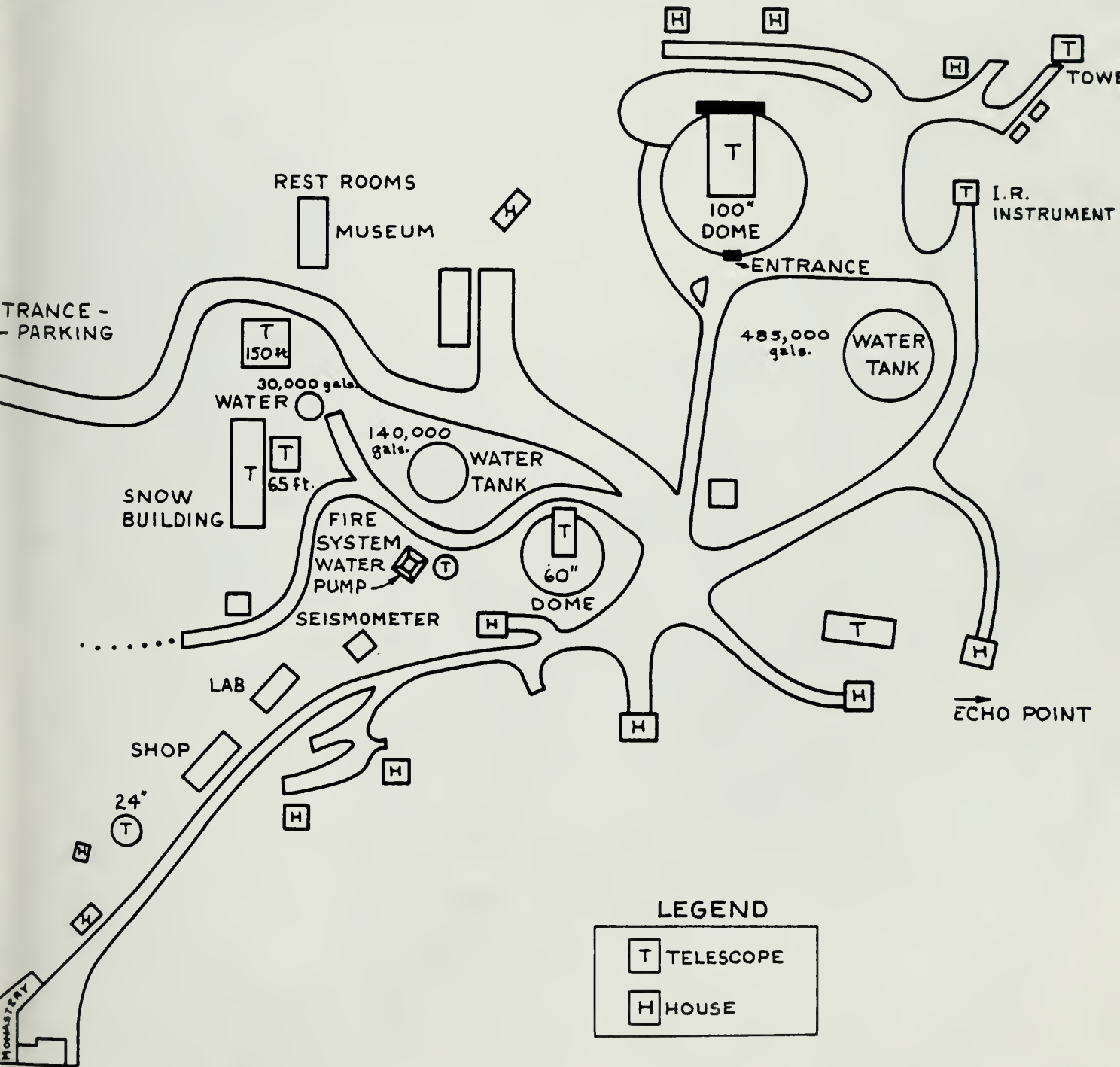
100 inch Telescope
60 inch Telescope

THE MOUNT WILSON OBSERVATORY

HALE OBSERVATORIES
CARNEGIE INSTITUTION OF WASHINGTON
CALIFORNIA INSTITUTE OF TECHNOLOGY



MT. WILSON FACILITIES



SCALE

1/4" = 25/64 SQUARE

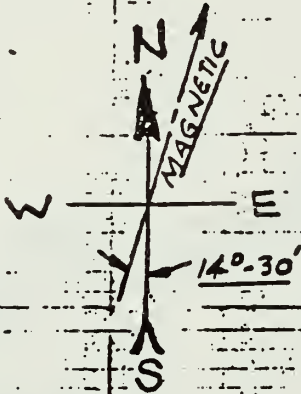
APPROX 5/8 ACRE

MOUNT WILSON QUADRANGLE SKETCH

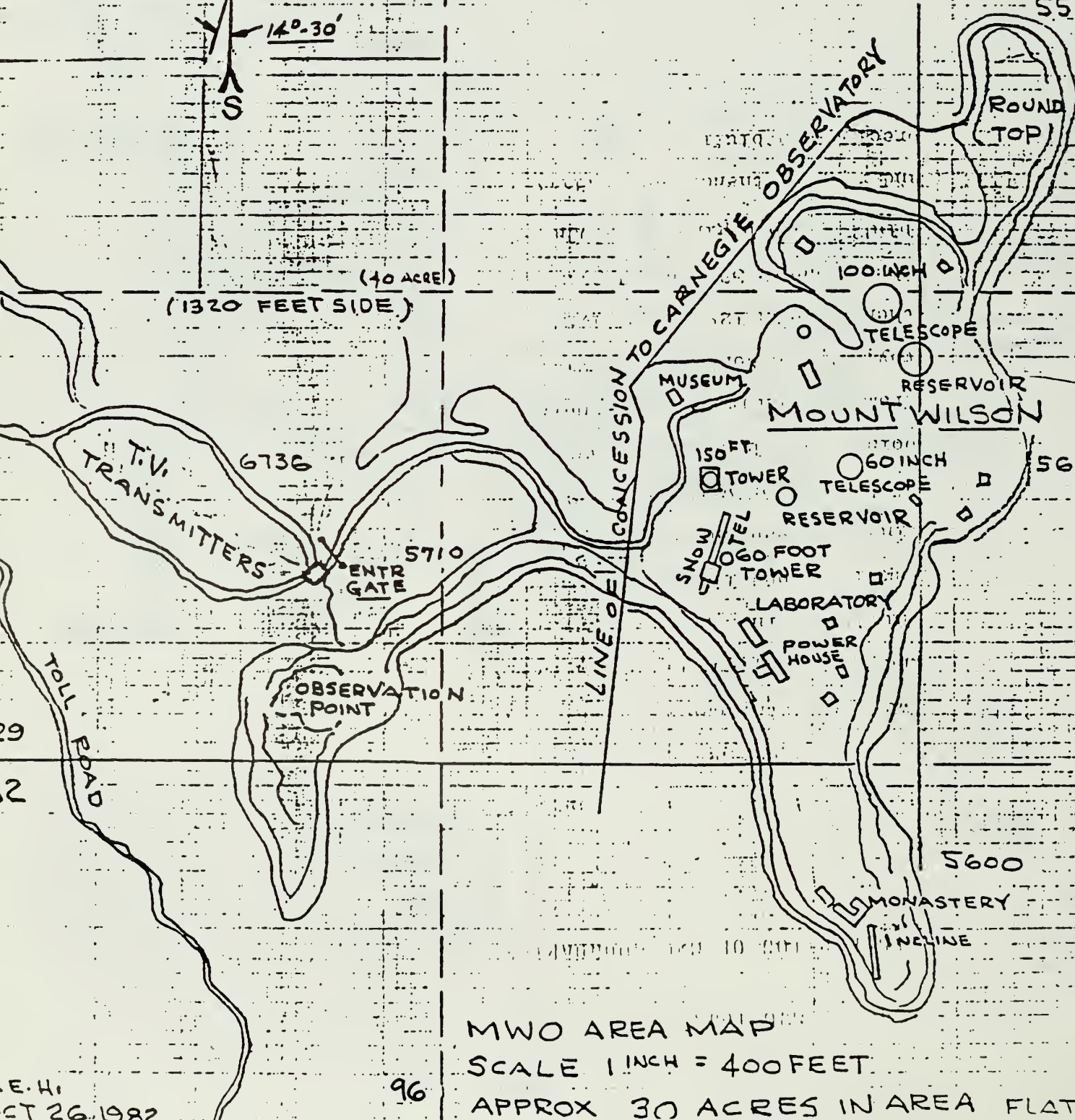
SK101-16

SECTION 29

TOWNSHIP TWO NORTH RANGE ELEVEN WEST, SAN BERNARDINO BASE AND MERIDIAN



(40 ACRE)
(1320 FEET SIDE)



MWO AREA MAP

SCALE 1 INCH = 400 FEET

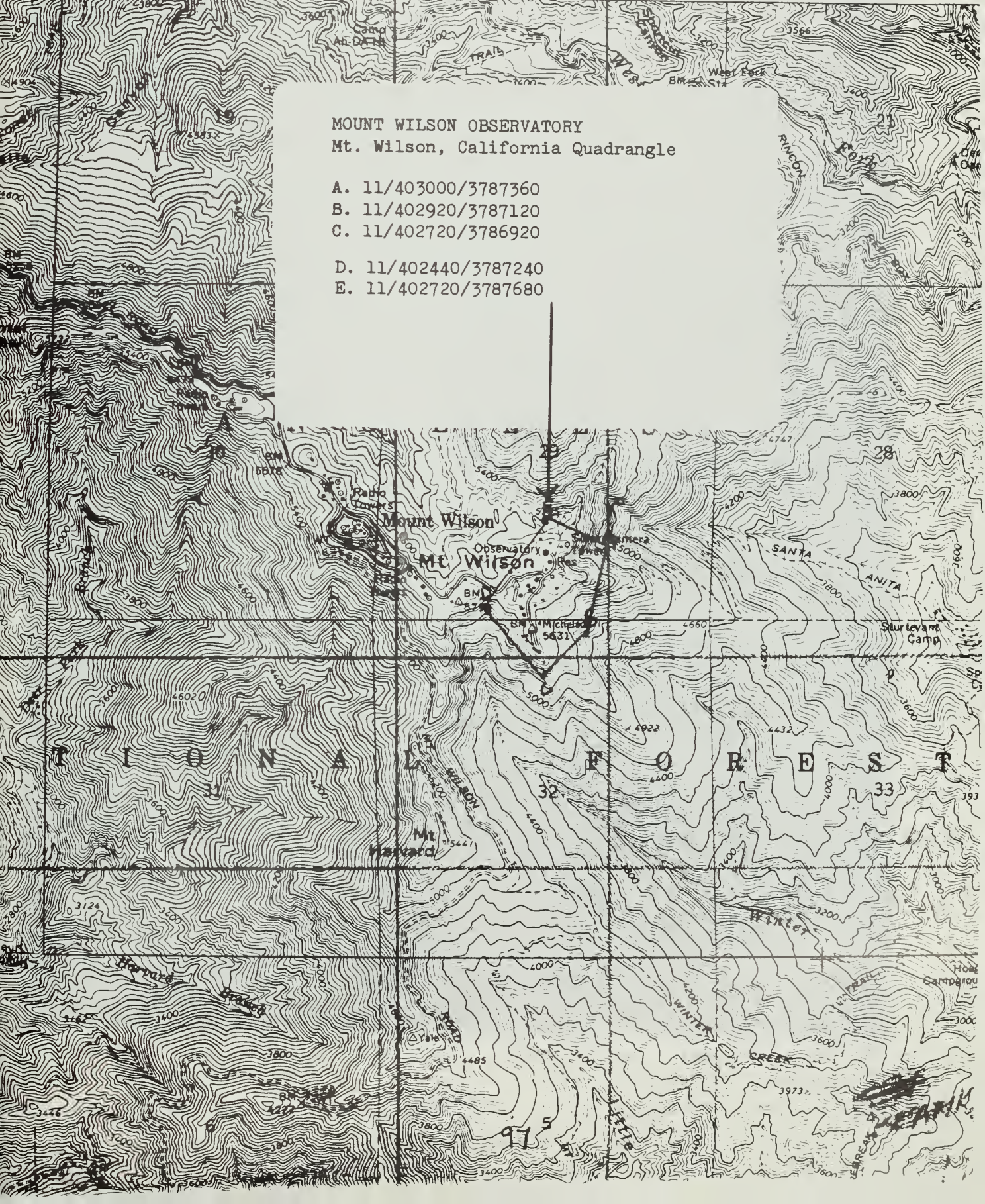
APPROX 30 ACRES IN AREA FLAT

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

W 5' R 11W 401 2352 1 SE (CHILAO FLAT) 403 2'30"

MOUNT WILSON OBSERVATORY
Mt. Wilson, California Quadrangle

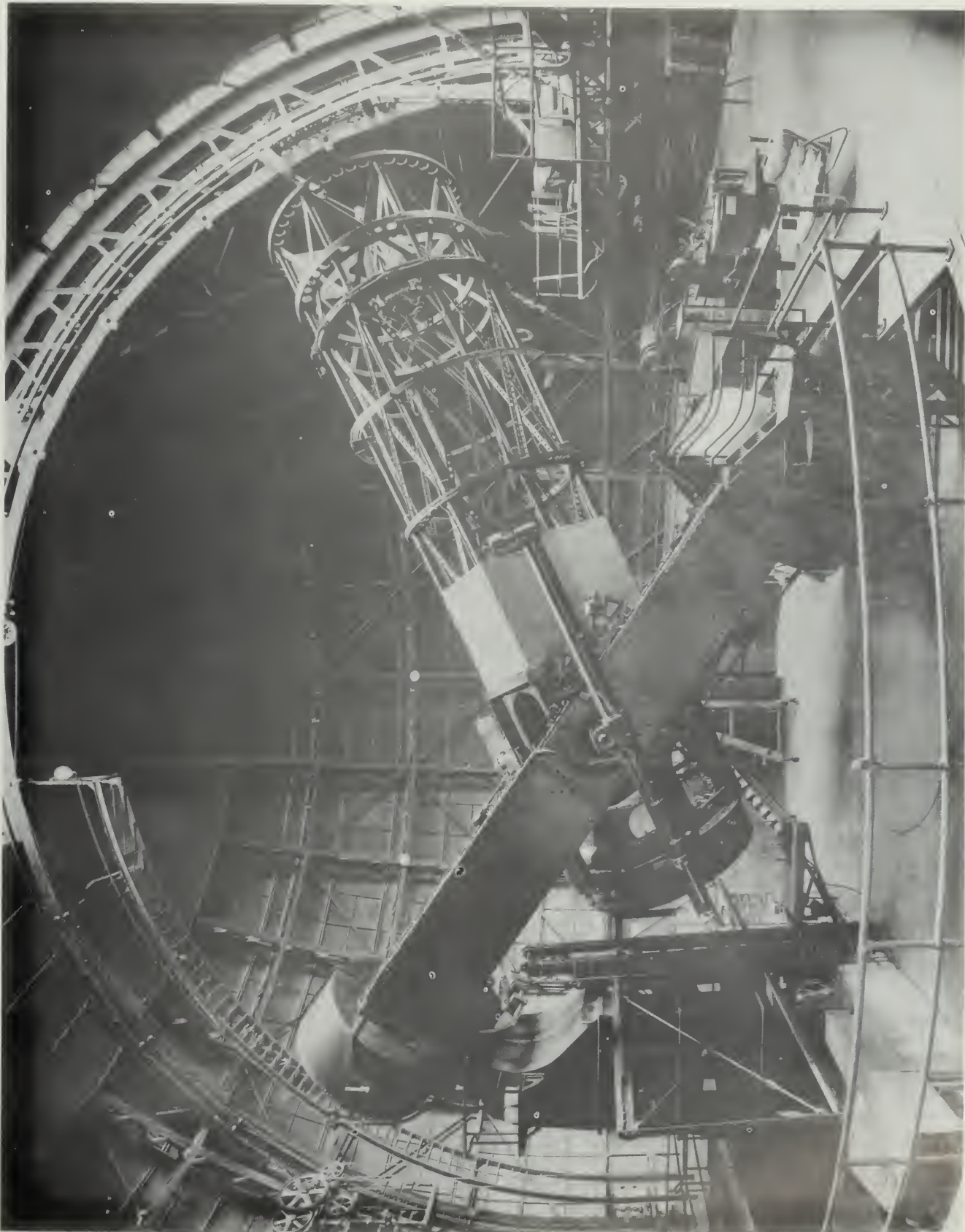
- A. 11/403000/3787360
- B. 11/402920/3787120
- C. 11/402720/3786920
- D. 11/402440/3787240
- E. 11/402720/3787680





Mount Wilson Observatory — Mount Wilson, California
100-inch Hooker Telescope Dome, circa 1970

Photo Credit: Mount Wilson Observatory



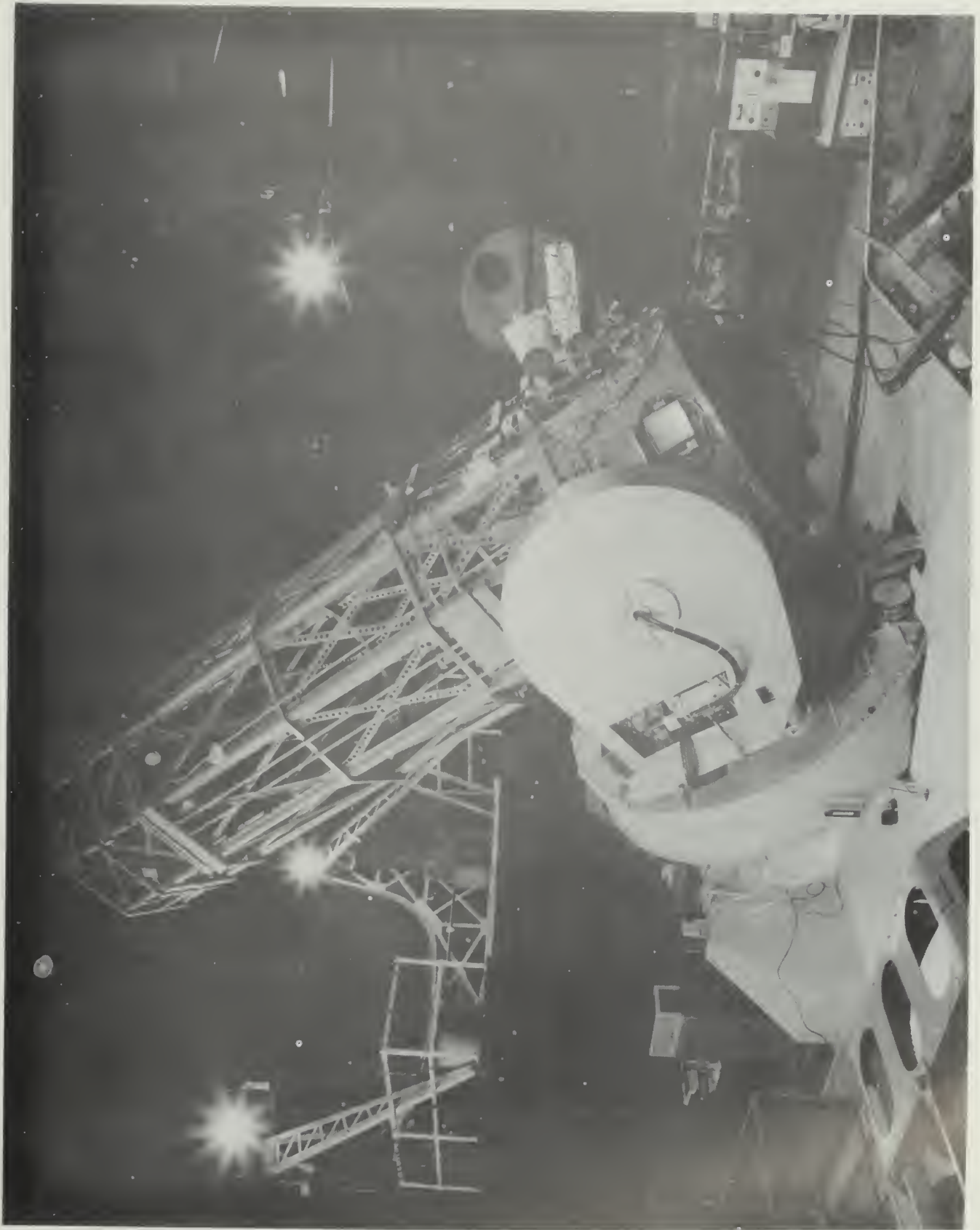
Mount Wilson Observatory — Mount Wilson, California
100-inch Hooker Telescope, circa 1970

Photo Credit: Mount Wilson Observatory



Mount Wilson Observatory — Mount Wilson, California
60-inch Telescope Dome, 1971

Photo Credit: Mount Wilson Observatory



Mount Wilson Observatory — Mount Wilson, California
60-inch Telescope, 1971

Photo Credit: Mount Wilson Observatory



Mount Wilson Observatory — Mount Wilson, California
150-foot Solar Tower Telescope, circa 1970

Photo Credit: Mount Wilson Observatory



Mount Wilson Observatory — Mount Wilson, California
60-foot Solar Tower Telescope, circa 1970

Photo Credit: Mount Wilson Observatory



Mount Wilson Observatory — Mount Wilson, California
Snow Telescope, circa 1970

Photo Credit: Mount Wilson Observatory

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name Palomar Hale Reflector
other names/site number Hale Telescope

2. Location

street & number Palomar Mountain not for publication
city, town San Diego County vicinity
state California code CA county San Diego code 073 zip code 91125

3. Classification

Ownership of Property	Category of Property	Number of Resources within Property	
<input checked="" type="checkbox"/> private	<input type="checkbox"/> building(s)	Contributing	Noncontributing
<input type="checkbox"/> public-local	<input type="checkbox"/> district	_____	_____ buildings
<input type="checkbox"/> public-State	<input type="checkbox"/> site	_____	_____ sites
<input type="checkbox"/> public-Federal	<input checked="" type="checkbox"/> structure	<u>1</u>	_____ structures
	<input type="checkbox"/> object	_____	_____ objects
		<u>1</u>	<u>0</u> Total

Name of related multiple property listing: _____
Number of contributing resources previously listed in the National Register _____

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of certifying official _____ Date _____
State or Federal agency and bureau _____

In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of commenting or other official _____ Date _____
State or Federal agency and bureau _____

5. National Park Service Certification

I, hereby, certify that this property is:

entered in the National Register.
 See continuation sheet.

determined eligible for the National Register. See continuation sheet.

determined not eligible for the National Register.

removed from the National Register.

other, (explain:) _____

Signature of the Keeper

Date of Action

6. Function or Use

Historic Functions (enter categories from instructions)

Research Facility

Current Functions (enter categories from instructions)

Research Facility

7. Description

Architectural Classification

(enter categories from instructions)

N/A

Materials (enter categories from instructions)

foundation concrete, steel, decomposed gr

walls concrete, steel, aluminum

roof N/A

other

Describe present and historic physical appearance.

The 200-inch Hale reflector is the principal instrument at the Palomar Observatory of the California Institute of Technology. The telescope was placed in operation on June 3, 1948, and dedicated to the memory of George Ellery Hale, whose leadership and vision were responsible for its creation.¹

The dome of the Palomar Observatory is 135 feet high and 137 feet in diameter and divided into two sections. The solid lower concrete portion is immovable while the upper aluminum and steel section can be rotated to permit the telescope to observe any section of the sky through the open shutters. The base section houses photographic dark rooms, telescope-control computers, library, lounge, storerooms, air-conditioning equipment, photographic plate storage vault, motor generators, massive switchboards, elevators, and an oil pumping system that supplies the main bearings of the telescope. The uppermost floor of the solid section houses the telescope. Adjacent to the telescope is a glassed-in observatory gallery from which visitors can view the instrument during daylight hours.

The movable upper section of the dome weighs 1000 tons and moves on tracks to permit the observation of any section of the sky. It rotates on 32 four wheel trucks which move so smoothly that no vibration is transmitted to the telescope. It is driven by two four-horsepower motors. The two shutters weigh 125 tons each and roll together at the end of each night's observation to seal the interior of the dome against the heat of the day and inclement weather.

The most important requirement in the design of the dome was good insulation. For this reason there is a four-foot gap between the concrete walls which form the base of the building. The interior wall is filled with aluminum foil insulation. There is also a four foot gap between the inner and outer walls of the steel dome. The inner face of the dome is made of aluminum panels built in the shape of boxes and filled with crumpled aluminum foil. The outside of the dome is composed of steel plates, 3/8-inch thick,

See continuation sheet

United States Department of the Interior
National Park ServiceNational Register of Historic Places
Continuation SheetSection number 7 Page 2

butt-welded and molded to form a strong but smooth hemispherical dome. As the warm air rises through the double walls of the building and the double layers of the dome, cool air enters below, thus preventing the heating of the dome from the Sun's rays during the day.

The foundation of the dome is anchored to the mountain while the foundation for the telescope is separately built on a base of crushed granite to protect the telescope from jar and vibration in the event of an earthquake.

Operational Description of the Hale Telescope

The main telescope tube carries the 200-inch mirror at its bottom end. This structure is supported on ball-bearing trunnions anchored in a large yoke, which consists of two 10-foot-diameter inclined tubular girders tied together at the south end by a cross member supported on a pivot bearing, and at the north end by a giant horseshoe bearing. The tube weighs 150 tons.

When in operation, light from the sky is concentrated by the 200-inch concave mirror into an image at the "prime focus" at the upper end of the tube. Longer focal lengths--and hence larger images--can be provided by inserting one or the other of two convex mirrors just ahead of the prime focus. The first of these, known as the Cassegrain secondary mirror, reflects the light down the tube through a hole in the center of the main mirror to a focus just below the bottom of the tube. If a still larger image is desired, the second convex mirror is substituted. With the aid of a diagonal flat mirror it sends the light down through the south polar-axis to a constant-temperature room in the stationary portion of the dome.

The horseshoe bearing mounting permits the main telescope tube to see the North Pole without interference. Oil is pumped through the pads supporting the horseshoe bearings at a pressure of 300 pounds per square inch, sufficient to lift the horseshoe and its load a few thousandths of an inch. Between these two bearings the entire 530 tons of moving parts of the telescope are "floated" on films of oil, providing virtually friction-free operation.

The right ascension drive consists of two large gears that are used to move the telescope; one gear slews the telescope east and west into the required position, while the other makes it follow the stars. A computer system is connected to the telescope to aim this system.

United States Department of the Interior
National Park Service

National Register of Historic Places Continuation Sheet

Section number 7 Page 3

The east and west declination trunnions are the pivotal bearings on which the telescope tube tilts north and south in declination. Located in each trunnion is an array of small motors and gear trains that provide slow motion fine adjustments of the declination setting.

The 200-inch primary mirror is the heart of the Hale Telescope. All of the other parts of the telescope have only one purpose--to make possible for the mirror to perform its light-gathering function as efficiently as possible. The mirror is supported at the bottom of the telescope tube on 36 delicate counterbalance supports to maintain rigidity. The delicate reflecting surface of the mirror is protected by covers that close like the petals of a flower over the glass disk.

The aluminizing chamber is a large steel tank located on the main floor of the dome next to the telescope. When necessary, the mirror is removed from the telescope and placed in the aluminizing chamber to replace the aluminum coating that provides the reflectivity for the mirror. The prime-focus observing capsule is located at the top of the telescope tube. The capsule contains a seat for the use of the observing astronomer. On the bottom of the observer's cage are hyperboloidal convex mirrors capable of changing the focal length of the telescope to suit various observing requirements.

The Cassegrain and Coude secondary mirrors are used to change the focal length of the telescope. With the use of this system, the focal length of the 200-inch mirror can be changed from 660 inches to an effective focal length of 6000 inches.

The Cassegrain-Coude diagonal mirror is mounted in line with the declination trunnions. This mirror reflects the image formed by the main mirror either into the yoke girder or down the south polar-axis to the Coude-spectrograph room.

The Coude-spectrograph room contains four spectrograph mirrors of different focal lengths. The room is light-tight and serves as a camera. The astronomer chooses the mirror with the focal length he requires and rolls it into the light beam on its carriage to make his observations.

New auxiliary equipment for the 200-inch Hale reflector is continually under development to enhance the light-gathering capabilities of the instrument and to keep it as one of the foremost research instruments in astronomy and astrophysics in the world today.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

nationally statewide locally

Applicable National Register Criteria A B C D NHL Criteria 1,2,3

Criteria Considerations (Exceptions) A B C D E F G

Areas of Significance (enter categories from instructions)

National Register: Education,
Engineering, Science

National Historic Landmark:
Science, Subtheme: Physical
Science, Facet: Astronomy

Period of Significance

1936-Present

Significant Dates

1936-

Present

Cultural Affiliation

N/A

Significant Person

George Ellery Hale

Architect/Builder

Dr. Russell W. Porter

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above

Summary

The construction and delivery of the Pyrex glass disk for the Palomar 200-inch reflector in 1936 marked a watershed in the history of astronomy. With the successful casting of this large mirror, the Palomar project, conceived by George Ellery Hale (1868-1938), and funded with a grant of \$6 million by the Rockefeller Foundation, moved toward the completion of the largest reflecting telescope in the world by 1948. In the 40 years since the completion of the Palomar project, the 200-inch reflector remains at the leading edge of research in the sciences of astronomy and astrophysics and stands today as a monument to George Ellery Hale and his efforts to produce the finest instruments in the world to answer the fundamental questions concerning the origin and nature of the universe.

History

Like buried treasures, the outposts of the universe have beckoned to the adventurous from immemorial times. Princes and potentates, political or industrial, equally with men of science, have felt the lure of the unchartered seas of space, and through their provision of instrumental means the sphere of exploration has rapidly widened.²

With this statement, astronomer George Ellery Hale opened his article in the April 1928 issue of Harper's Magazine to set forth the case for the building of what was to become the 200-inch Palomar reflector. The purpose of this article was to inform the American public about his proposal to construct the largest telescope in the world to answer questions relating to the fundamental nature of the universe. Hale hoped that the American people would understand and support his project.

Hale followed this article with a letter to the International Education Board (later absorbed into the General Education Board) of the Rockefeller Foundation dated April 28, 1928, in which he requested funding for this project. In his letter, Hale stated:

See continuation sheet

National Register of Historic Places Continuation Sheet

Section number 8 Page 2

No method of advancing science is so productive as the development of new and more powerful instruments and methods of research. A larger telescope would not only furnish the necessary gain in light space-penetration and photographic resolving power, but permit the application of ideas and devices derived chiefly from the recent fundamental advances in physics and chemistry.³

Hale was successful beyond his dreams when the Rockefeller Foundation voted to support the project with a grant of \$6 million. The Palomar project (named after Palomar Mountain that was to be the site of the new observatory) was now under way.

The effort to build the 200-inch telescope was easily the most famous scientific undertaking of the 1930s. From the beginning, everyone associated with the project realized that the work must be done right or not at all. Every task associated with the Palomar project required a considerable extension of the technology of the day.⁴

For example, no 200-inch mirror had ever been cast before. The largest reflector in 1928, at the time Hale proposed the Palomar project, was the 100-inch mirror in the Hooker telescope at Mount Wilson, California. The 100-inch Hooker had also been conceived and brought to completion by Hale, but the Hooker telescope raised at least as many questions as it answered. The 200-inch mirror was to be the largest and most difficult telescope Hale ever constructed.

The Mount Wilson 100-inch mirror, a five-ton instrument, was a midget when compared to the estimated 40 tons necessary for a 200-inch mirror. Hale led the search for new materials to construct the 200-inch mirror investigating metal alloys, fused quartz, and a new glass technology called "Pyrex." After much experimentation and failure, Pyrex was selected as the best material. The contract for the mirror was given to the Corning Glass Works. Borrowing from then current construction technology, a solid sheet of glass was rejected in favor of a hollow reinforced ribbed disk. After a successful trial run which led to the casting of a 120-inch disk, Corning was ready to cast the 200-inch mirror. The first attempt was a failure when the molds broke loose and floated to the top. The problem with the mold was corrected and the mirror was finally cast in 1936. By April the disk was delivered safely to Pasadena, California, for grinding and polishing--a task that would eventually take twelve years to complete.

Other tasks, as great as the grinding of the blank glass disk, involved the designing of the tube that was to house the mirror and the auxiliary optical equipment, the engineering of methods that would make the huge instrument responsive to delicate adjustments, and the design and construction of the huge dome to house the telescope.

United States Department of the Interior
National Park ServiceNational Register of Historic Places
Continuation SheetSection number 8 Page 3

For the mechanical design of the telescope Hale decided to use oil-pad bearings and the Serrurier truss. This was to overcome known limitations of a more traditional fork type mount that would not permit the telescope to observe the north pole and placed undue stress on the telescope's bearings in certain observing positions. The use of the Serrurier truss, in which the deflections of the primary and secondary mirror-support system are matched to maintain correct mirror alignment, was a convincing solution to the problem of telescope flexing. This system permitted the placement of the primary and secondary mirrors 43 feet apart at opposite ends of a 140-ton tube and allowed the mirrors to remain in alignment to within 1/100-inch. This new method also allowed the telescope to reach the entire sky. The use of oil-pad bearings with the Serrurier truss made the weight of the entire structure unimportant since the bearings would carry almost any load and, if the weight made the telescope bend, the mirror alignment was still under control.⁵

George Ellery Hale died in 1938 and did not live to see the completion of his last telescope. In June 1948 the 200-inch reflector was dedicated to his memory. The Hale reflector made it possible to photograph and resolve distant objects as dim as the 26th magnitude--objects only 1/40,000,000 as bright as the dimmest object visible to the naked eye. It detected faint galaxies that were billions of light years from the earth. It enabled astronomers to detect and resolve astronomical objects much better than was possible with the Hooker reflector, the largest telescope in the world prior to 1948.⁶ Speaking at the dedication of the 200-inch reflector Dr. Lee Du Bridge, President of the Carnegie Institute said:

This great telescope before us today marks the culmination of over two hundred years of astronomical research. And for generations to come it will be the key instrument in Man's search for knowledge.⁷

The superior optical qualities of the 200-inch Hale reflector were demonstrated by astronomer Maarten Schmidt who came to the California Institute of Technology in 1959. Schmidt was interested in certain radio sources that astronomer Allan Sandage had managed to pinpoint to what looked like individual stars. The spectra of these radio-emitting stars were not familiar and astronomers were not able to make any sense of them. In 1963, using the 200-inch Hale reflector, Schmidt realized that the unfamiliarity of the spectra was the result of an enormous red shift and that the lines were familiar ones that ought to be in the ultraviolet section of the spectrum. This turned out to be correct and the enormous red shift indicated the objects to be very distant, a billion light years away and more. Since the objects were too distant to be stars, or even galaxies, Schmidt concluded, they must be something else not previously seen in the history of astronomy. They were called "quasi-stellar objects"; that is, objects with a star like appearance or "quasars" for short.⁸

United States Department of the Interior
National Park Service

National Register of Historic Places Continuation Sheet

Section number 8 Page 4

The discovery of quasars has had an enormous impact on modern astronomy. Most scientific discoveries either strengthen an existing scientific concept or result in the birth of a new theory. The discovery of quasars, however, has resulted in the bewilderment of astronomers since there is no easy way to explain their existence. The consequence of their discovery was that one either had to question the validity of the yardstick of the astronomer, the red shift, or to agree that there are processes out there for which we have no explanation.⁹

While new technologies have led to the construction of larger telescopes based upon techniques not known in 1948, the Hale reflector remains in the forefront of research in the fields of astronomy and astrophysics and is the largest successful reflecting telescope in the world today. With the construction of this telescope, Hale pushed the technology of the monolithic mirror reflecting telescope to its physical limits and created one of the finest research telescopes in the world. The technology of the giant Pyrex glass mirror, cast in 1936, remains the best in astrophysics. A 1947 CAL Tech publication refers to the final polishing of the mirror as "...the most daring optical job ever attempted."¹⁰ The Hale reflector stands today as a monument to George Ellery Hale and his quest for better and more efficient instruments to answer the fundamental questions concerning the origin and evolution of the universe.

United States Department of the Interior
National Park Service

National Register of Historic Places Continuation Sheet

Section number 8 Page 5

Footnotes

1. The description of the 200-inch Hale reflector was taken from the following sources:

Staff of the Palomar Observatory, Giants of Palomar (Hansen Planetarium, 1983).

Helen Wright, Palomar: The World's Largest Telescope (New York: Macmillan Company, 1952), pp. 154-57.

2. George Ellery Hale, "The Possibilities of Large Telescopes," Harper's Magazine, April 1928, p. 639.

3. Bob Clark, et al., "The Palomar Observatory Project" (Unpublished Report, Files of the Palomar Observatory, 1983), p. 1.

4. Ibid., 11.

5. Richard Learner, "The Legacy of the 200-Inch," Sky & Telescope, 71 (April 1986), p. 350.

6. Isaac Asimov, Eyes On The Universe (Boston: Houghton Mifflin Company, 1975), p. 185.

7. Patrick Moore, Patrick Moore's History of Astronomy (London: Macdonald & Co. 1977), p. 154.

8. Isaac Asimov, Asimov's Biographical Encyclopedia of Science & Technology (New York: Doubleday & Company, 1982), p. 890.

9. Alexander Hellemans and Bryan Bunch, The Timetables of Science: A Chronology of the Most Important People and Events in the History of Science (New York: Simon and Schuster, 1988), p. 541.

10. Clark, pp. 16-17.

National Register of Historic Places Continuation Sheet

Section number 9 Page 2

Bibliography

- Abell, George O. Exploration of the Universe. 4th. ed. Philadelphia: Saunders College Publishing, 1982.
- Asimov, Isaac. Eyes On The Universe. Boston: Houghton Mifflin Company, 1975.
- Asimov, Issac. Asimov's Biographical Encyclopedia of Science & Technology. New York: Doubleday & Company, 1982.
- Clark, Bob. et al. "The Palomar Observatory Project." Unpublished Report, Files of the Palomar Observatory, 1983.
- Di Cicco, Dennis. "The Journey of the 200-inch Mirror." Sky & Telescope, April 1986, pp. 347-48.
- Hellmans, Alexander and Bunch, Bryan. The Timetables of Science: A Chronology of the Most Important People and Events in the History of Science. New York: Simon & Schuster, 1988.
- Hale, George Ellery. "The Possibilities of Large Telescopes." Harper's Magazine, April 1928, pp. 639-646.
- Kirby-Smith, H.T. U.S. Observatories: A Directory and Travel Guide. New York: Van Nostrand Reinhold Company, 1976.
- Learner, Richard. Astronomy Through the Telescope. New York: Van Nostrand Reinhold Company, 1981.
- _____ : "The Legacy of the 200-inch." Sky & Telescope, April 1986, pp. 349-353.
- Moore, Patrick. Patrick Moore's History of Astronomy. London: Macdonald & Co., 1977.
- Staff of the Palomar Observatory. Giants of Palomar. Hansen Planetarium, 1983.
- Woodbury, David O. The Glass Giant of Palomar. New York: Dodd, Mead & Company, 1954.
- Wright, Helen. Palomar: The World's Largest Telescope. New York: The Macmillan Company, 1952.

9. Major Bibliographical References

SEE CONTINUATION SHEET

Previous documentation on file (NPS):

- preliminary determination of individual listing (36 CFR 67) has been requested
- previously listed in the National Register
- previously determined eligible by the National Register
- designated a National Historic Landmark
- recorded by Historic American Buildings Survey # _____
- recorded by Historic American Engineering Record # _____

See continuation sheet

Primary location of additional data:

- State historic preservation office
- Other State agency
- Federal agency
- Local government
- University
- Other

Specify repository: _____

10. Geographical Data

Acreeage of property less than 1 acre

UTM References

A

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5	1	2	6	6	0
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3	6	9	0	6	0	0
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Zone Easting Northing

B

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Zone Easting Northing

C

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D

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See continuation sheet

Verbal Boundary Description

The boundary follows the outside perimeter of the structure.

See continuation sheet

Boundary Justification

The boundary includes only the Palomar Observatory building, the sole resouce which is nationally significant.

See continuation sheet

11. Form Prepared By

name/title Harry Butowsky
organization National Park Service date May 1, 1989
street & number 1100 L Street, NW telephone (202) 343-8155
city or town Washington state DC zip code 20013

Palomar Observatory is owned and operated by the California Institute of Technology, a privately endowed educational and research institution located in Pasadena, California. The observatory not only supports the scientific research programs of Caltech's faculty and students but also those of astronomers from other institutions.

The principal instrument for this research is the 200-inch Hale Telescope, the largest productive telescope in the world. Other telescopes at Palomar include the 48-inch and 18-inch Schmidt telescopes and the 60-inch reflecting telescope, which is operated jointly by Caltech and the Carnegie Institution of Washington.

The history of Palomar Observatory really began in the mid-1920s, when results from Mount Wilson Observatory's 100-inch telescope demonstrated the need for a larger instrument if expected advances in astronomical research were to be realized. As a result of the foresight and work of astronomer George Ellery Hale, in 1928 the International Education Board (one of the Rockefeller Foundations) awarded a grant to Caltech for the construction of a 200-inch telescope. Numerous locations were tested for the atmospheric conditions needed for optimum astronomical observing, and in 1934 Palomar Mountain was selected as the site for the new instrument.

Meanwhile, at the Corning Glass Works in New York State, techniques were being developed that ultimately led to the successful casting of the 200-inch Pyrex-glass disk on December 2, 1934. After a cooling period of eight months, the 20-ton disk was shipped by rail to Pasadena for the long process of grinding and polishing that would transform it into the precise shape and size required for



NGC 598, *The Spiral Galaxy*

Construction of the building to house the 200-inch (including the 1,000-ton rotating dome) and the telescope structure (the moving parts weigh about 530 tons) began in the mid-1930s and was nearly complete by 1941 when the United States entered World War II. But the war delayed polishing of the mirror, and it was not until November 18, 1947, that the finished mirror, now weighing only 14.5 tons, began its two-day trip to Palomar Mountain where it was installed in the telescope for a period of testing and adjustment.

Finally, on June 3, 1948, this superb instrument was dedicated to the memory of George Ellery Hale who, by his vision and determination, had such a profound influence on the development of scientific studies during the early part of the 20th century.

Scientific research at Palomar Observatory since 1948 has been remarkably productive. The Hale Telescope has been used on virtually every clear night to provide astronomers with the information they need to pursue their investigations. The scope of this work ranges from studies of asteroids and comets within the

galaxies beyond our own, and finally to the quasars — beacons in the universe so distant that the light collected from them with the Palomar telescopes has been billions of years in transit to the Earth.

By careful study of the light from these celestial objects, astronomers hope to extend our understanding of the universe. How did the Sun and planets form? How do stars form, evolve, and die? How old is the Milky Way? How old is the universe? How did it form, and what is its fate? The telescopes at Palomar Observatory are the tools astronomers need to answer these and other similar questions about the universe.

These tools are constantly being improved. Within the past several years, for example, the 200-inch telescope has been equipped with sensitive position sensors and high-speed computers — modifications that greatly improve the efficiency of its operation. Even more significant is the development of new electronic devices that sense faint signals of light from distant celestial objects. Some of these devices are 100 times more sensitive than the photographic plates used when the telescope first went into service. Others are able to measure infrared light, a part of the spectrum that was inaccessible to astronomers in 1948. Because of these improvements, the 200-inch Hale Telescope can now be used to attack research problems that would have been impossible just a few years ago.

Although electronic detectors have replaced photographs at the 200-inch telescope, this is not the case at the 48-inch Schmidt, a telescope designed for wide-field viewing. The Schmidt can be thought of as a camera, where glass photographic plates 14 inches square are needed to record the image. It is currently

PALOMAR OBSERVATORY

California Institute of Technology

Light pollution is an increasing problem for observatories everywhere. One of the reasons Palomar Mountain was selected as the site for the 200-inch telescope was its dark skies that would allow observation of the faintest galaxies without the interference of city lights. Since 1934, rapid urbanization of southern California has resulted in a significant increase in the amount of sky glow. If such light pollution continues to increase, it will seriously reduce the effectiveness of the Palomar Observatory. Fortunately, steps can be taken to minimize those effects. These include:

- Using the minimum amount of outdoor lighting required for the task.
- Shielding lights to prevent any direct upward illumination.
- Turning lights off when they are not needed.
- Using low-pressure sodium lights wherever possible because these lights cause the least interference with the observatory.

Visitors are welcome at Palomar Observatory, which can be reached by taking California Highway 76 to County Road S6, a winding mountain road that leads to the observatory gate. Typical driving time is 3 hours from Los Angeles and 2 hours from San Diego.

The observatory is open daily (except December 24 and 25) from 9 a.m. to 4:30 p.m. Visitors may tour the Gift Shop (open daily from July 1 to August 31, weekends only during the remainder of the year) and the Museum and view the 200-inch Hale Telescope (until 4:00 p.m.) from the special gallery in the dome.

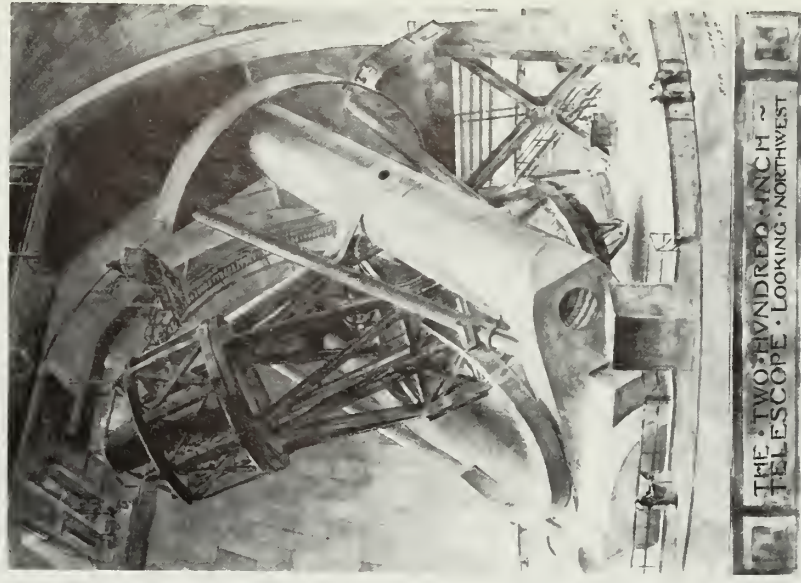
Since Palomar Observatory is a research facility, all of its resources must be dedicated to that function. As a result, viewing through the telescopes, night-time visits, or guided tours cannot be accommodated.



200-inch Dome and Telescope

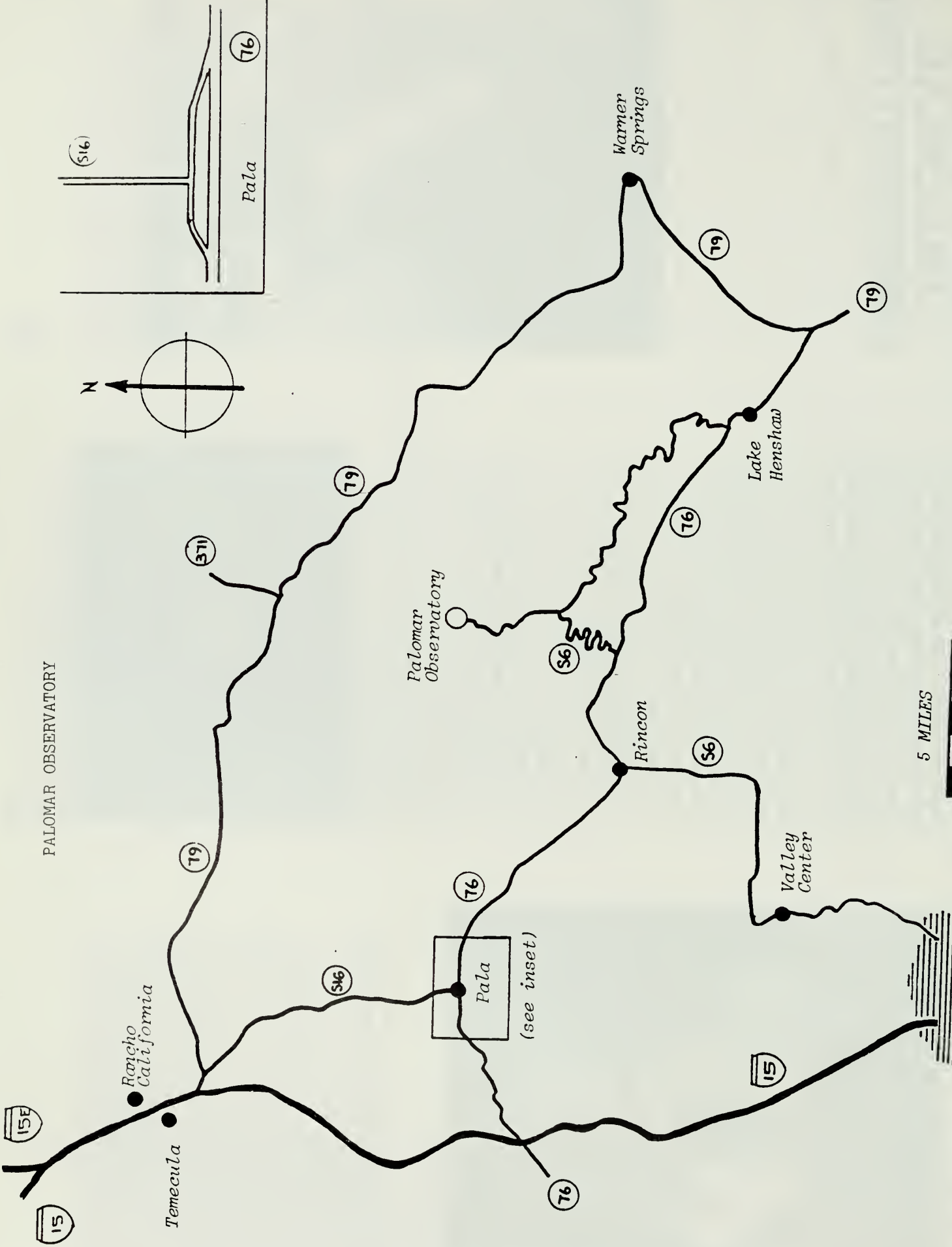
resulting photographic sky atlas will constitute a basic source of astronomical information for researchers throughout the world.

Much of the light radiated by the stars, galaxies, and quasars is at wavelengths that are absorbed by the atmosphere of the Earth. To collect this light, astronomers are now able to operate highly specialized telescopes that orbit the Earth above the atmosphere. The relationship between these space telescopes and those at ground-based observatories like Palomar is complementary. Neither space-based nor ground-based observatories can accomplish alone what they can working in concert.

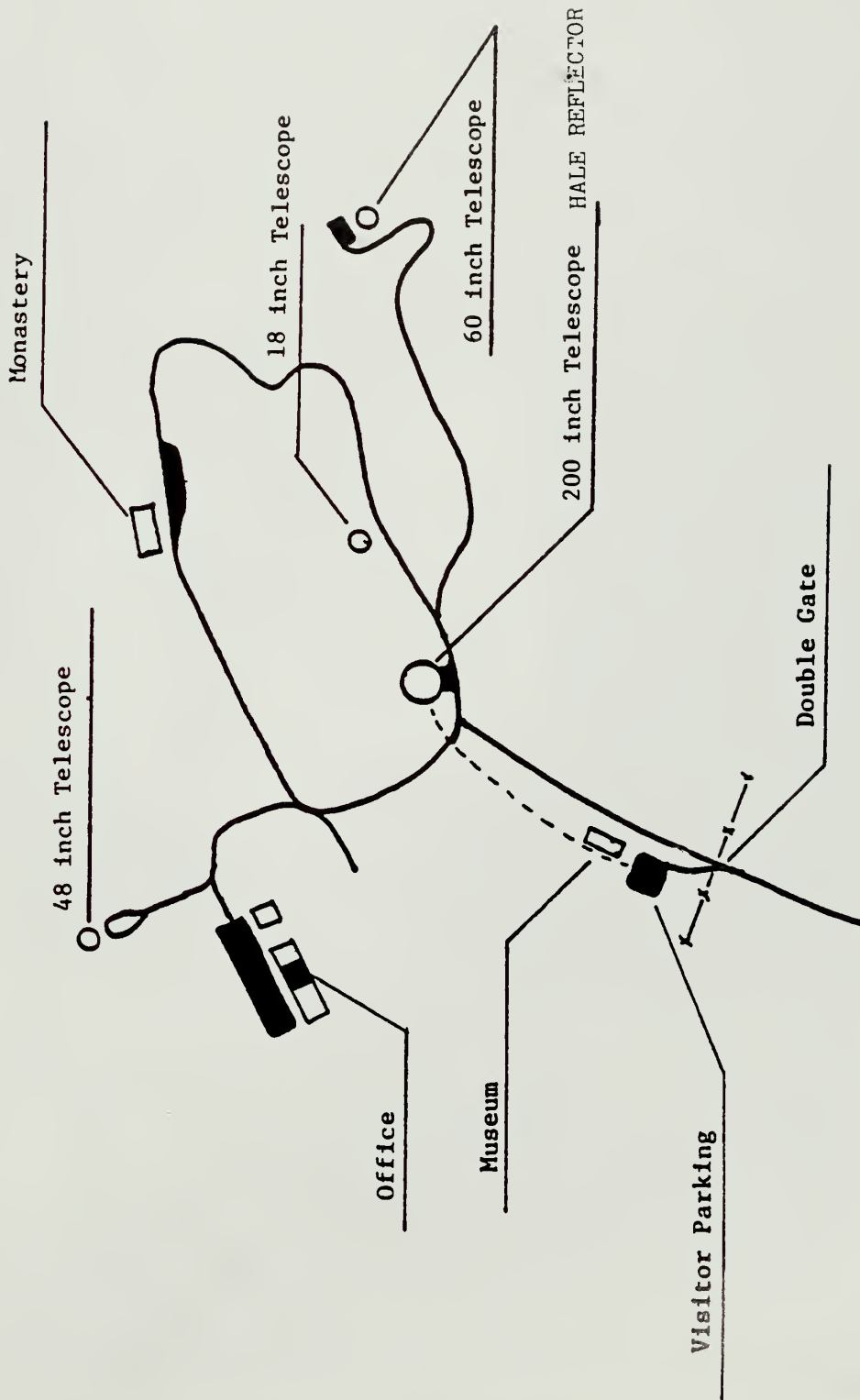


Russell Porter's 1938 drawing of the 200-inch Telescope

PALOMAR OBSERVATORY



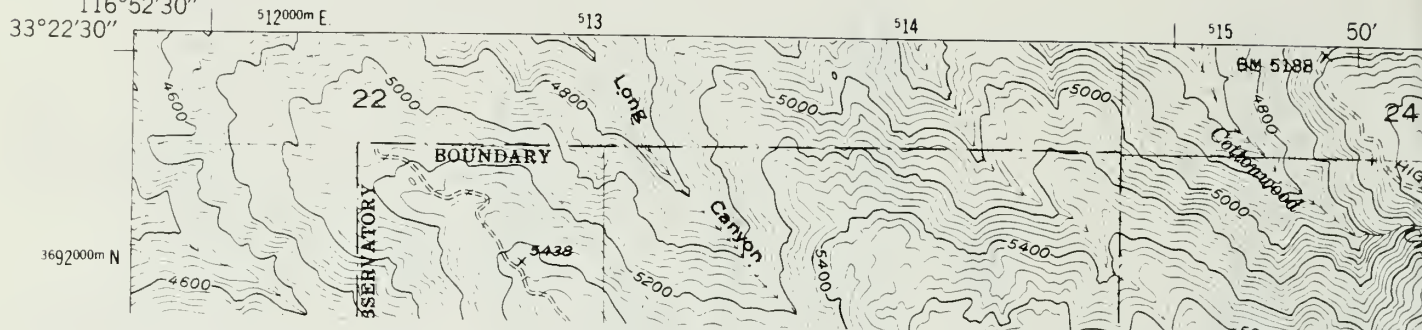
PALOMAR OBSERVATORY



2650 IV NW
(VAIL LAKE)

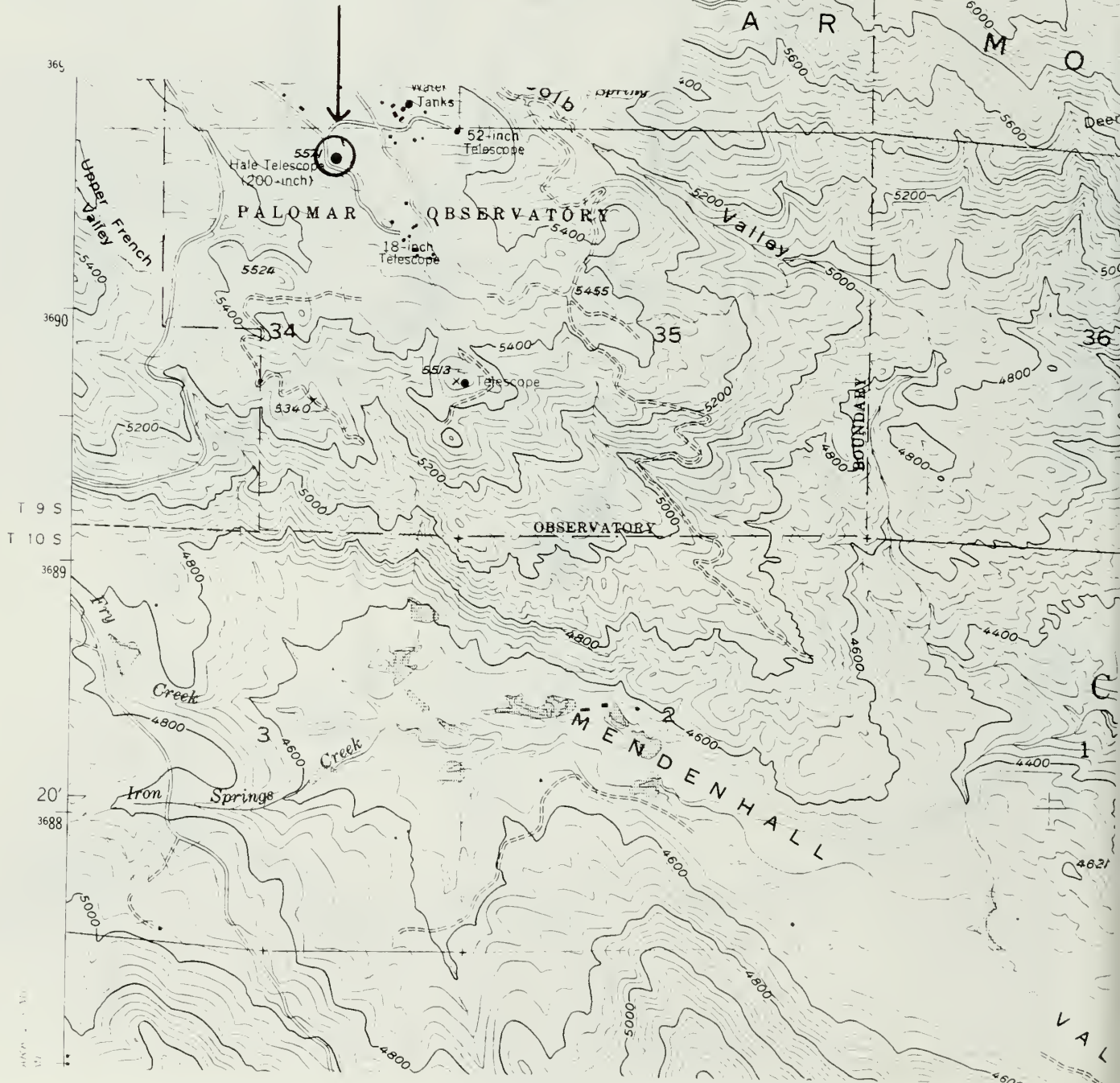
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

116°52'30" 512000m E 513 514 515 50'



PALOMAR HALE REFLECTOR
Palomar Observatory Quadrangle

17/52660/3690600





Palomar Observatory — San Diego County, California
Moonlight View of the 200-inch Dome of the Hale Telescope, circa 1983

Photo Credit: Palomar Observatory



Palomar Observatory — San Diego County, California
200-inch Hale Telescope pointing to the north pole, circa 1988

Photo Credit: Palomar Observatory



Palomar Observatory — San Diego County, California
200-inch Hale Telescope, showing the observer in prime-focus observing position, circa 1988

Photo Credit: Palomar Observatory



Palomar Observatory — San Diego County, California
200-inch Hale Telescope pointing to the zenith, circa 1988

Photo Credit: Palomar Observatory

United States Department of the Interior National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in Guidelines for Completing National Register Forms (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name Palomar 48-inch Telescope
other names/site number The Big Schmidt, The Oschin Telescope

2. Location

street & number Palomar Mountain
city, town San Diego County
state California code CA county San Diego code 073 zip code 91125

3. Classification

Ownership of Property: private (checked)
Category of Property: structure (checked)
Number of Resources within Property: Contributing 1, Noncontributing 0, Total 1

Name of related multiple property listing:
Number of contributing resources previously listed in the National Register 0

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

5. National Park Service Certification

I, hereby, certify that this property is:
entered in the National Register.
determined eligible for the National Register.
determined not eligible for the National Register.
removed from the National Register.
other, (explain:)

Signature of the Keeper

Date of Action

6. Function or Use

Historic Functions (enter categories from instructions)

Education

Research Facility

Current Functions (enter categories from instructions)

Education

Research Facility

7. Description

Architectural Classification

(enter categories from instructions)

N/A

Materials (enter categories from instructions)

foundation concrete, steelwalls concrete, steelroof N/A

other

Describe present and historic physical appearance.

The 48-inch Schmidt telescope (Oschin telescope) at the Palomar Observatory is a standard Schmidt camera telescope using both lenses and mirrors to create a wide field of view for photographing large sections of the sky at one time.¹ Construction on the Schmidt telescope began in 1939 and was completed in 1948.

The telescope was manufactured in the Caltech machine shops and consists of a tube 20 feet long in a fork-type mounting which allows the telescope to sweep all parts of the sky from the north pole to as far south as declination minus 45 degrees. The combined weight of the fork and tube is more than 12 tons. This assembly moves on a 2-inch ball bearing in the polar axis. The tube, partly cylindrical and partly conical, is made of 5/16-inch welded steel plate. The telescope shutter consists of two rotating shells located inside the tube behind the correcting plate. This construction allows the correcting plate to be removed or auxiliaries to be mounted without removing the shutters. The mirror and its cells are mounted at the lower end of the tube and are kept at a constant distance from the focal surface, regardless of temperature fluctuations, by means of three floating metal alloy rods.

The telescope uses Selsyn indicators which take their signals from declination and right-ascension gears and transmit the position electrically to the control desk. Other electrical features include automatic limit switches which stop the telescope four degrees from the horizon, automatic control of the dome's rotation, and automatic regulation of the wind-screen height. The telescope is driven by a 1/25-horsepower synchronous motor.

Two sizes of photographic plates are used in the camera: 10 inches square and 14 inches square. The spherical mirror is 72 inches in diameter and has a radius of curvature of 241 inches. The corrector plate at the upper end of the tube is 49.75 inches in diameter. The 48-inch telescope, at an optical speed of f/2.5 covers an angular field of 7 degrees. The telescope is guided by two 10-inch refractors attached on each side of the tube.

 See continuation sheet

**United States Department of the Interior
National Park Service****National Register of Historic Places
Continuation Sheet**Section number 7 Page 2

The telescope was overhauled recently to prepare for the new Palomar sky survey project sponsored by the National Geographic Society. A new 48-inch-diameter corrector plate was made by Grubb-Parsons in England and installed in the telescope. This new plate produces better images over a wider range of wavelengths than the original. Other new equipment includes an automatic guider and an internal calibration source for placing technical information at the edge of each plate while the sky exposure is being made. There is also a photometer to monitor sky brightness and provide a zero point for the calibration.²

The dome housing the 48-inch Schmidt is 48 feet in diameter and 48 feet high and is located about a quarter mile east of the 200-inch Hale reflector. Darkrooms, offices, and a study are found on the ground floor while the second floor is occupied by the telescope.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

nationally statewide locally

Applicable National Register Criteria A B C D NHL Criteria I

Criteria Considerations (Exceptions) A B C D E F G

Areas of Significance (enter categories from instructions)

National Register
Engineering, Science

National Historic Landmark:
Science, Subtheme: Physical Science,
Facet: Astronomy

George Ellery Hale

Period of Significance

1948-Present

Significant Dates

Cultural Affiliation

Significant Person

Architect/Builder

Don Hendrix

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above

Summary

Although not as well known as the 200-inch Hale reflector, the 48-inch Schmidt telescope (Oschin telescope) at the Palomar Observatory has performed invaluable scientific research and has prepared the way for many of the important discoveries made by the 200-inch. This instrument was first used in 1950, to carry out two surveys of the Northern Hemisphere, one through a red filter and one through a blue, so that a comparison of the two black and white prints would reveal how cool (red) or how hot (blue) a star was. The surveys involved taking 1758 plates of the northern sky and recorded stars never seen before. The Palomar sky survey is the standard reference atlas for deep sky observation and provides a base line with which to measure changes in deep sky observation targets in future surveys. It is used as a standard reference tool for all modern observatories doing deep sky observation.³

History

The successful construction and use of large reflecting telescopes in the 20th century increased the need to have accurate deep sky star maps that would provide suitable targets for observation. Although large telescopes, such as the 100-inch Hooker reflector at Mount Wilson, could peer deeply into the cosmos, they could only cover a small section of the sky at one time. The optics of the large parabolic mirrors in these reflectors permitted observation of objects only in a narrow viewing area. These telescopes were therefore unsuitable for mapping the sky to discover interesting targets for future observation. What was needed was a reflecting telescope that could see deeply into space, and also photograph large sections of the sky to produce accurate sky maps needed to guide the large reflectors.

A solution to this problem was reached by a Russian-German optician, Bernhard Voldomar Schmidt (1879-1935) who, in the 1920s, conceived of a compromise between reflectors and refractors, instruments that made use

See continuation sheet

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 8 Page 2

of both mirrors and lenses.⁴ Schmidt's solution was to design a telescope that used a spherical mirror with a "corrector plate," a lens that could be placed at the center of curvature of the sphere and through which the light would pass. The corrector plate lens is thickest in the center, less thick at the edges, and least thick between the edges and the center. Schmidt designed the plate to refract the light passing through it in such a way as to make up for the spherical aberration introduced by the mirror, without introducing visual errors such as chromatic aberrations commonly found in large reflectors.

Since the "Schmidt telescope" could take photographs over wide sections of the sky and gain large amounts of information at one time, its use spread rapidly in the 1930s, to increase the efficiency of the large reflectors. A Schmidt telescope could survey a wide field, producing single photographs containing the images of as many as 1,000,000 stars and 100,000 galaxies, and, if anything in that field looked suspicious or interesting, a reflector could then observe the object more closely.⁵

During the construction of the large 200-inch Hale reflector on Palomar Mountain the astronomers at Caltech realized the need to build a large Schmidt telescope to work with the 200-inch reflector. The result was the construction of the 48-inch Schmidt telescope which could photograph large sections of the sky in a short period of time.

During the 1950s the National Geographic Society and the Palomar Observatory collaborated on the original Palomar Sky Survey. This work took five years to complete and remains the deepest photographic record of the entire northern sky. When the project was begun the heavens were almost unexplored territory at the faint limiting magnitudes reached with the 48-inch Schmidt. The idea was to identify objects that could be studied in greater detail with the 200-inch reflector.⁶

The Palomar Sky Survey was an unqualified success by the time of its completion in 1957. Many discoveries were made with these photographs, including distant star clusters, dwarf spheroidal galaxies, dwarf galaxies in the local group, and clusters of galaxies. Astronomers have used the survey for morphological studies of galaxy classification and for work on peculiar galaxies. The survey has been heavily relied on to identify objects at wavelengths outside the visible spectrum, such as radio galaxies, X-ray sources, and quasars. It has also proven valuable for making finder charts to aid in deeper studies with other telescopes.⁷

The 48-inch Schmidt is now being used to complete a new survey of the sky that will supplement and update the original sky survey. When completed

United States Department of the Interior
National Park Service

National Register of Historic Places Continuation Sheet

Section number 8 Page 3

this survey, taken together with the original work, will form a data base of information about deep sky objects, that will enable astronomers to observe changes in the sky over a period of 30 years and to formulate new theories about the nature and extent of the universe.

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 8 Page 4

Footnotes

1. The descriptive material in this section was taken from the following source.
Albert G. Wilson, "The Big Schmidt," Scientific American, December 1950,
pp. 34-41.
2. James Schombert, "Surveying the Northern Sky," Sky & Telescope, August 1987,
p. 129.
3. Richard Learner, Astronomy Through the Telescope (New York: Van Nostrand
Reinhold Company, 1981), p. 129.
4. The information from this paragraph was taken from the following source:
Isaac Asimov, Eyes On The Universe (Boston: Houghton Mifflin Company, 1975),
pp. 179-80.
5. Ibid.
6. Schombert, p. 128.
7. Ibid.

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 9 Page 2

Bibliography

Abell, George O. Exploration of the Universe. 4th ed., Philadelphia: Saunders College Publishing, 1982.

Asimov, Isaac. Eyes On The Universe. Boston: Houghton Mifflin Company, 1975.

Kirby-Smith, H.T. U.S. Observatories: A Directory and Travel Guide. New York: Van Nostrand Reinhold Company, 1976.

Learner, Richard. Astronomy Through the Telescope. New York: Van Nostrand Reinhold Company, 1981.

_____. "The Legacy of the 200-inch," Sky & Telescope, April 1986, pp. 349-53.

Staff of the Palomar Observatory. Giants of Palomar. Hansen Planetarium, 1983.

Schombert, James. "Surveying the Northern Sky," Sky & Telescope, August 1987, pp. 128-31.

Wilson, Albert G. "The Big Schmidt," Scientific American, December 1950, pp. 35-40.

Woodbury, David O. The Glass Giant of Palomar. New York: Dodd, Mead & Company, 1954.

Wright, Helen. Palomar: The World's Largest Telescope. New York: The Macmillan Company, 1952.

9. Major Bibliographical References

See Continuation Sheet

Previous documentation on file (NPS):

- preliminary determination of Individual listing (36 CFR 67) has been requested
- previously listed in the National Register
- previously determined eligible by the National Register
- designated a National Historic Landmark
- recorded by Historic American Buildings Survey # _____
- recorded by Historic American Engineering Record # _____

See continuation sheet

Primary location of additional data:

- State historic preservation office
- Other State agency
- Federal agency
- Local government
- University
- Other

Specify repository: _____

10. Geographical Data

Acreeage of property less than 1 acre

UTM References

A 17 512710 3691100
 Zone Easting Northing

C _____

B _____
 Zone Easting Northing

D _____

See continuation sheet

Verbal Boundary Description

The boundary follows the outside perimeter of the building.

See continuation sheet

Boundary Justification

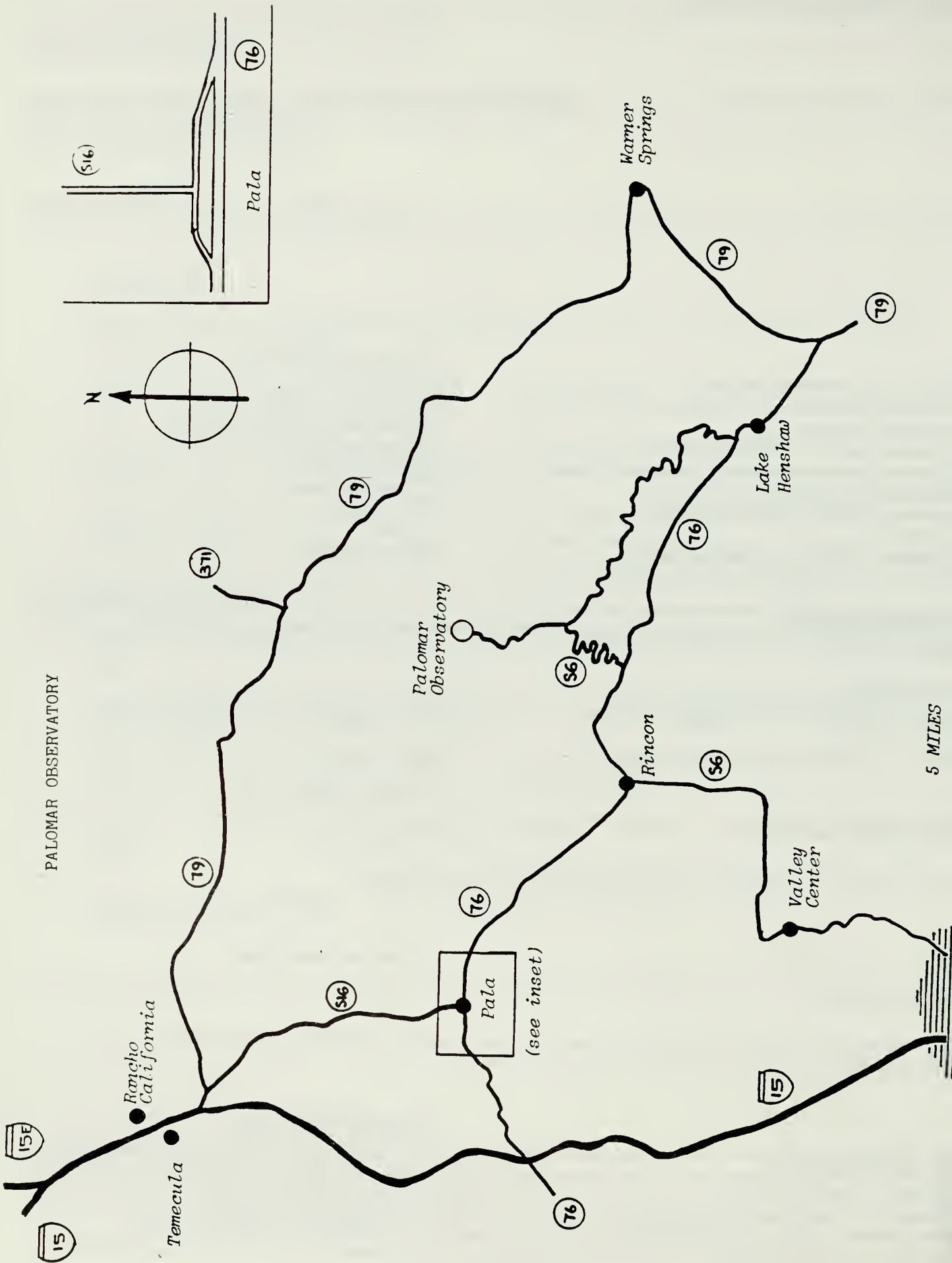
The boundary includes only the Palomar 48-inch Schmidt Observatory structure, the sole resource which is nationally significant.

See continuation sheet

11. Form Prepared By

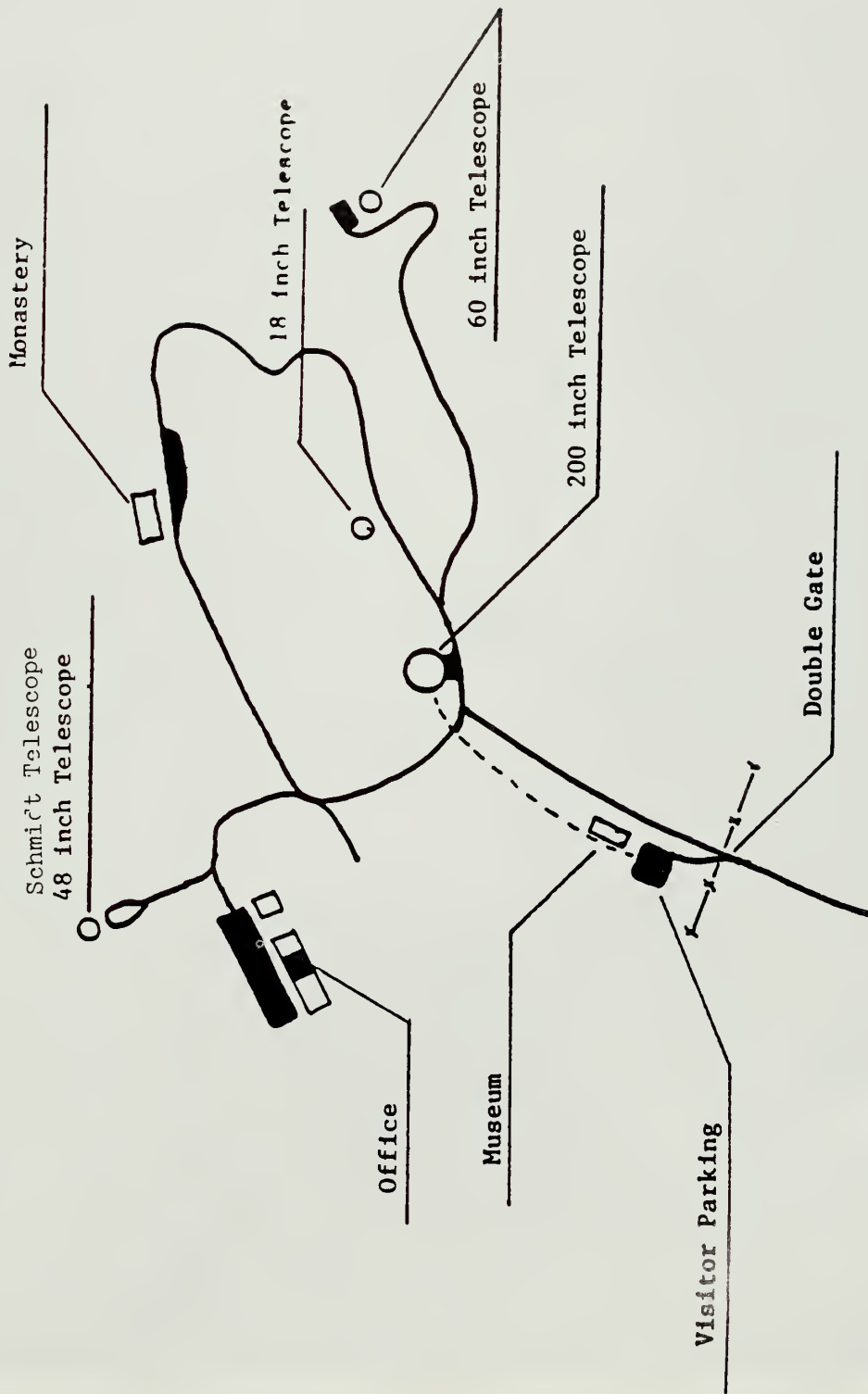
name/title Harry Butowsky
 organization National Park Service date May 1, 1989
 street & number 1100 L Street, N.W. telephone (202) 343-8155
 city or town Washington state DC zip code 20013

PALOMAR OBSERVATORY



5 MILES

PALOMAR OBSERVATORY



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

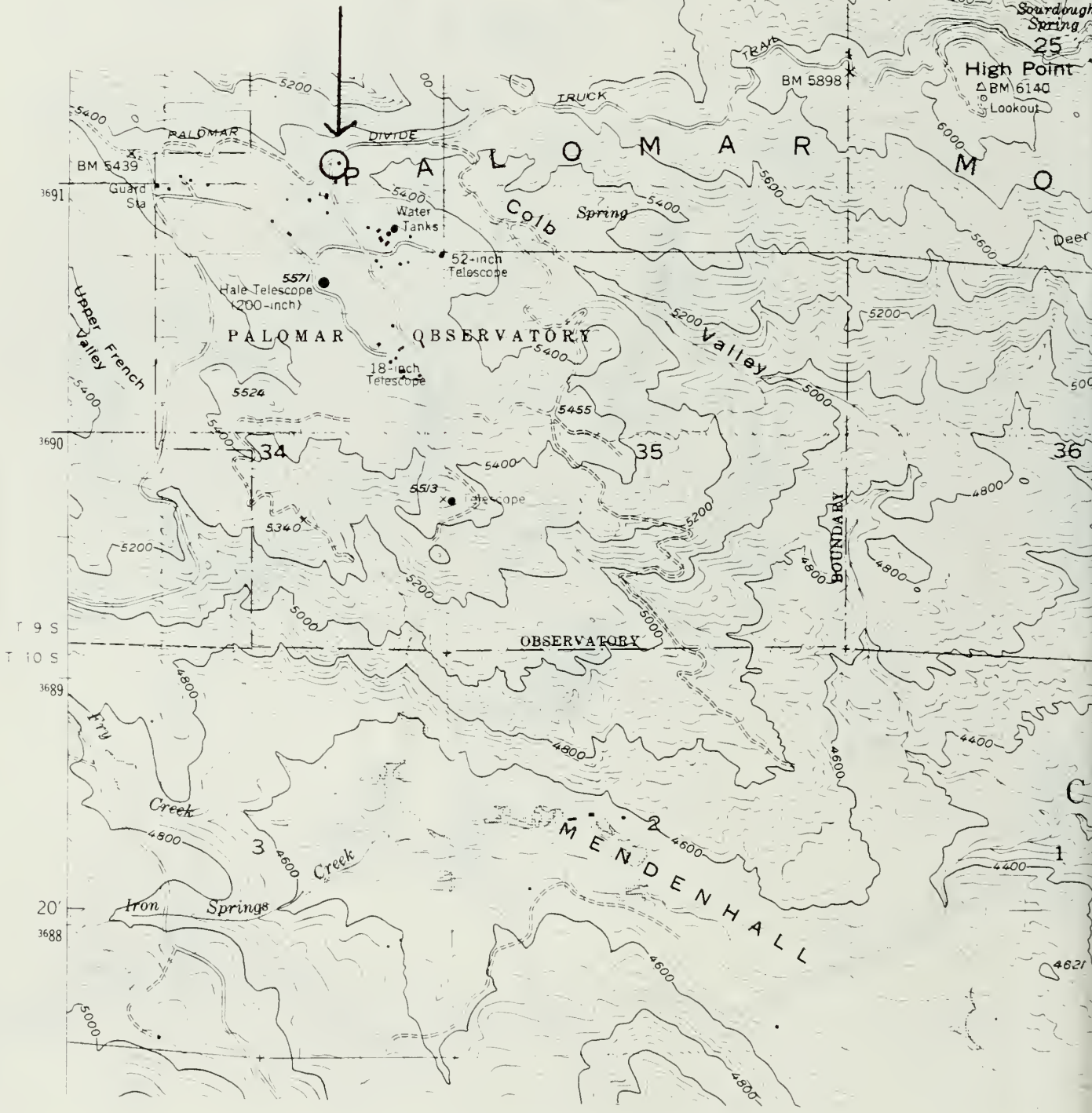
2650' V. NW
(VAIL LAKE)

116°52'30" 512000m E 513 514 515 50'

33°22'30"
3692000m

PALOMAR 48-INCH SCHMIDT TELESCOPE
Palomar Observatory Quadrangle

17/512710/3691100





Palomar Observatory — San Diego County, California
Exterior View of the 48-inch Schmidt Telescope Dome, circa 1988

Photo Credit: Palomar Observatory



Palomar Observatory — San Diego County, California
Interior View of the dome and the 48-inch telescope, circa 1960

Photo Credit: Palomar Observatory

United States Department of the Interior
National Park Service

National Register of Historic Places
Registration Form

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name United States Naval Observatory
other names/site number _____

2. Location

street & number 34th & Massachusetts Ave., NW not for publication
city, town Washington vicinity
state DC code DC county DC code 001 zip code 20390

3. Classification

Ownership of Property	Category of Property	Number of Resources within Property	
<input type="checkbox"/> private	<input checked="" type="checkbox"/> building(s)	Contributing	Noncontributing
<input type="checkbox"/> public-local	<input type="checkbox"/> district	<u>8</u>	<u>58</u> buildings
<input type="checkbox"/> public-State	<input type="checkbox"/> site	_____	_____ sites
<input checked="" type="checkbox"/> public-Federal	<input type="checkbox"/> structure	_____	_____ structures
	<input type="checkbox"/> object	<u>8</u>	<u>58</u> Total

Name of related multiple property listing: _____
Number of contributing resources previously listed in the National Register _____

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of certifying official _____ Date _____
State or Federal agency and bureau _____

In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of commenting or other official _____ Date _____
State or Federal agency and bureau _____

5. National Park Service Certification

I, hereby, certify that this property is:

entered in the National Register.
 See continuation sheet.

determined eligible for the National Register. See continuation sheet.

determined not eligible for the National Register.

removed from the National Register.

other, (explain:) _____

Signature of the Keeper

Date of Action

6. Function or Use

Historic Functions (enter categories from instructions)

Research Facility

Current Functions (enter categories from instructions)

Research Facility

7. Description

Architectural Classification

(enter categories from instructions)

Classical Revival, Egyptian

Materials (enter categories from instructions)

foundation Brick

walls Stone, Brick

roof Copper

other

Describe present and historic physical appearance.

The U.S. Naval Observatory dates from 1830 when the Depot of Charts and Instruments was established under the control of the Navy Department to care for chronometers, charts and other navigational equipment. By a Congressional appropriation of 1842 the Depot was re-established in 1844 in new permanent quarters on the knoll north of the present Lincoln Memorial, at 23rd and E Streets NW, in Washington, DC. In 1854 the institution was officially designated the United States Naval Observatory and Hydrographic Office. The Hydrographic office was officially separated in 1866.

The E street site proved to be a poor choice for an astronomical observatory due to the mud flats and swampy land immediately to the south and west and the closeness of the Potomac River which caused foggy conditions. Since the Naval Observatory required a clear atmosphere free from the smoke and heat radiation of nearby buildings, in 1880 the Congress authorized the purchase of a new site. The area chosen was the 73-acre Barber estate in the country north of Georgetown, presently 34th St. and Massachusetts Ave., NW, in Washington, DC. At the time of the purchase the site contained a mansion, stable and many outbuildings. This new site was chosen for the rural character of the estate and the fact that the land had the highest elevation in the Washington, DC, area. The architect for the Naval Observatory was Richard Morris Hunt, who began work on the original nine buildings in the Spring of 1887. By 1893 the new Naval Observatory was in operation.

To protect the integrity of the astronomical instruments from unwanted vibrations that would interfere with operations, Congress passed a Joint Resolution August 1, 1894 (28 Stat. L. 588), prohibiting the construction of any highways within the area of a circle described with a radius of one thousand feet from the center of the clock room of the observatory. The circle thus described marks the official boundary of the observatory. In 1988 the District of Columbia Zoning Commission provided further protection for the Naval Observatory by declaring the area immediately adjacent to the observatory as a Naval Observatory Precinct District.

 See continuation sheet

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Continuation Sheet

Section number 7 Page 2

Contributing Structures

The following buildings, designed and constructed under Hunt's supervision, contribute to the significance of the Naval Observatory as a National Historic Landmark.

The Main Building, now known as the James Melville Gilliss Building, is 69 feet wide and 307 feet long. This building has two stories and a basement with stone and brick walls, and houses the offices of the Naval Observatory and the Oceanographer of the Navy. The east end of the building has a circular extension with a conical roof that houses the library of the Naval Observatory, while the west end houses a telescope tower for a 12-inch Alvan Clark refractor. The main section of the building and the library extension are covered with dressed stone with Greek classical details and the telescope end with rock-face stone with Egyptian details.

The Great Equatorial Building (renamed for astronomer Asaph Hall in 1966) is 46 feet wide and 72 feet long with one story and a basement with stone and brick walls. The historic 26-inch Alvan Clark refractor originally placed in operation in 1873 is in this building. In 1892, in preparation for the move to the new Naval Observatory, a new mounting was ordered from the Warner and Swasey Company in Cleveland, Ohio, for the sum of \$28,700, since the original mounting design by Clark had been found to be too light. Warner and Swasey also built the 45-foot, 24-ton steel dome that surmounts the rough white Tuckahoe marble exterior of the building. The objective lens of the telescope was installed in June 1893 and the telescope was ready for regular observation by December. An elevator hardwood floor in the observing room moves up and down to facilitate the use of the telescope in different positions. The floor moves through a range of 12 feet from the lower to the upper balcony. It has to be near its lowest point when a star near the zenith is observed. In intermediate positions it can be quickly adjusted to any height from the eyepiece of the telescope.

No further major changes were made on the 26-inch refractor until 1958 when an overhaul and maintenance program was initiated. By 1964 the project had done away with the pier platform and its spiral access stairway and the auxiliary telescopes and periscopes which had been used for remote reading of the circles. Also, the mechanical fast and slow-motion rods and clamps were replaced by variable-speed clutches to transmit fast-motion power to the axes, synchro-systems with easily read console dials, and variable speed slow motions. The old clock drive was replaced with an electric one. A new tailpiece was added and an iris diaphragm installed ahead of the objective.

The Clock room is a one-story building 18 x 20 feet with a basement and stone and brick walls. For many years some of the most delicate clocks of the observatory were kept in this room. The clock room is at the exact center of the observatory circle.

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Section number 7 Page 3

The two Observers' rooms measure 18 x 20 feet and are found in a one-story frame building on a foundation of masonry.

The East Transit Circle and West Transit Circle buildings each measure 30 x 40 feet. Both structures are one-story buildings with iron frames on a foundation of masonry. The West Transit Circle building contains the six-inch meridian (transit) circle used exclusively for astrometry, with horizontal collimators, and north and south meridian marks. The instrument can be easily reversed to remove systematic errors in observations for determining the celestial latitudes of stars. Both circles are accurately divided. The instrument is provided with a motor driven micrometer. This telescope was designed by William Harkness of the observatory staff and built by Warner and Swasey, and mounted in 1897. The East Transit Circle building originally contained a 9-inch transit circle, modified from an older transit circle first used by Simon Newcomb. It was decommissioned in 1945 and was eventually replaced by a new 7-inch transit circle, designed and built at the Naval Observatory. The 7-inch transit circle was relocated to New Zealand in 1984 to begin astrometry observations in the southern hemisphere. Four small wooden structures (marker houses), used to align the transit telescopes, are found to the north of the East and West Transit Circle buildings and are considered to be part of these buildings.

The Boiler-house measures 45 x 54 feet and is a three-story building with stone and brick walls and is connected to the main building via a tunnel.

The Superintendent's House, designed by architect Leon Dessez, is a three-story brick structure with extensive use of dormers in the Queen Anne style. The house was originally used as the official residence of the Superintendent of the Naval Observatory. It is now used as the official residence of the Vice-President of the United States. No current information concerning this structure is available to the public.

The original brick carriage house and stable of the Barber estate, built around 1860, still stands. This building is a two-story brick L-shaped structure 88 feet x 68 feet x 31 feet with steep pitched roof, Federal style windows and rooftop ventilating cupolas. The carriage house is now used by the Secret Service.

Non-Contributing Structures

All other structures at the Naval Observatory, including the Simon Newcomb laboratory, gate houses, garages, greenhouses, storage buildings, dormitories and various maintenance facilities, are not part of this nomination and are not considered to contribute to the significance of the Naval Observatory as a National Historic Landmark.

3. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

nationally statewide locally

Applicable National Register Criteria A B C D NHL Criteria 1

Criteria Considerations (Exceptions) A B C D E F G

Areas of Significance (enter categories from instructions)

National Register
Military, Science

Period of Significance

1893-Present

Significant Dates

1893-
Present

National Historic Landmark:
Science, Subtheme: Physical Science
Facet: Astronomy; Theme Technology
(Engineering and Invention): Measure-
ment, Observation & Control

Cultural Affiliation

Significant Person

Architect/Builder

Richard Morris Hunt

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

Summary

The United States Naval Observatory is the oldest scientific institution in the Navy, being first established in 1830 as the Depot of Charts and Instruments. The observatory is most noted for its work in the study of positional astronomy and timekeeping. The Naval Observatory, along with the Royal Observatory in Greenwich, England, and the Pulkovo Observatory in the Soviet Union, is one of the few places in the world that continually observes and determines the positions of the sun, moon, planets, and stars. The United States Naval Observatory is the only place in the United States where precise instruments measure celestial motions to provide accurate time and other astronomical data which are essential for safe navigation at sea, in the air, and in space. ²

History

The first attempts to establish a national astronomical observatory in the United States dates back to 1810 when the first proposals were introduced into Congress. In spite of strong support from such notables as Thomas Jefferson and John Quincy Adams, most Americans were reluctant to support funds for scientific research. When the Department of the Navy finally established the Depot of Charts and Instruments, celestial observations were needed to rate the chronometers stored there. Once begun, astronomical activities increased rapidly and by 1842, with the authorization of the first permanent buildings, the United States had a national observatory.

Until 1893 the observatory was located at 23rd and E Streets in Washington, DC. Under the leadership of Matthew Fontaine Maury, the Naval Observatory achieved wide acclaim for advances in astronomy, navigation, and oceanography. In the post-Civil War era leading mathematicians and astronomers such as Simon Newcomb, C. Henry Davis, George William Hill and Asaph Hall won world esteem. In 1877 for example, Asaph Hall used the historic 26-inch Alvan Clark Refractor at the Naval Observatory to discover the two moons of Mars--Phobos and Deimos.

See continuation sheet

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Section number 8 Page 2

By the early 1880s the location and facilities of the observatory were no longer suitable. In 1893 the observatory moved to a new site at 34th and Massachusetts Avenue with new buildings designed by architect Richard Morris Hunt. At this time the Nautical Almanac Office also became part of the Naval Observatory system.

Since 1893 the scientific research at the observatory has related primarily to timekeeping and to the determination, maintenance and dissemination of time, and to the determination of the fundamental celestial positions, motions and constants, which collectively comprise the field of astrometry. The United States Naval Observatory is the only institution in the United States where such fundamental observations are made on a regular basis. Scientists in the Nautical Almanac Office combine this data from the astrometry programs with the theories of motion of the solar system to compute the future positions of the sun, moon, and planets. This information, along with star positions, is made available to navigators, surveyors, geodesists, and astronomers, and forms the basis for all of their work. The Naval Observatory is the source of official time used in the United States and has been charged with maintaining the Department of Defense reference for precise time.

The fundamental work of the Naval Observatory in the study of astrometry cannot be overemphasized. This astronomical and timing data is essential for accurate navigation and the support of communications on Earth and in space, and is vital to both the Navy and the Department of Defense. This data is used for everything from guiding missiles to determining the distances to other galaxies and is used extensively by other governmental agencies and the public at large.

The Old Naval Observatory was made a National Historic Landmark in 1965, more than seventy years after the relocation of the observatory to the Massachusetts Avenue location. The designation of the 23rd and E Street site was based upon its association with Matthew Fontaine Maury, the father of modern oceanography, and leading astronomers and mathematicians such as Simon Newcomb, George William Hill and Asaph Hall, the discoverer of the two moons of Mars in 1877. The fundamental work of the New Naval Observatory since 1893 is in the specialized field of astrometry. For the past century the Navy has conducted astrometry observations from the same site using the same instruments. The period of time involved means that observations made today can be compared with observations made 10, 20 or even 90 years ago. By comparing modern observations with those taken years ago the Navy can accurately chart the positions of the stars and planets with a precision not available anywhere else in the United States. The site, the telescope, the buildings and even the weather patterns are the same. This accuracy of these observations forms a data base upon which the disciplines of astronomy, navigation, geodesy and surveying depend. It was in recognition of the importance of this work that the Congress originally moved the observatory to the Massachusetts Avenue site away from the traffic and congestion of Washington and established a large boundary containing sufficient buffer land to protect the delicate instruments from the heat and vibrations arising from normal city traffic.

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For many years the Naval Observatory has been regarded as the American National Observatory. By devoting its research to the science of astrometry, while other American observatories have studied more modern subjects, the Naval Observatory has earned a unique place in the history of American astronomy.

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Footnotes

1. The descriptive material for this section was taken from the following sources:

Circular Relating to the Construction of the New Naval Observatory (Washington, DC: Navy Department, 1888). pp. 13-14.

Gustavus A. Weber, The Naval Observatory: Its History, Activities and Organization (Baltimore: Johns Hopkins University Press, 1926), pp. 76-78.

Paul R. Baker, Richard Morris Hunt (Cambridge, Massachusetts: MIT Press, 1980). pp. 380-381.

R. W. Rhynsburger, "A Historic Refractor's 100th Anniversary," Sky and Telescope, October 1973, pp. 2-8.

"The New Naval Observatory, Washington, DC," American Architect and Building News, October-December 1892, pp. 121-122.

2. The material for the statement of significance was taken from the following sources:

Blanche H. Schroer and Steven H. Lewis, "National Register of Historic Places Inventory Nomination Form-Old Naval Observatory." (Washington, DC: National Park Service, Historic Sites Survey Division, 1977).

Deborah Warner, "United States Naval Observatory," in Astrophysics and twentieth-century astronomy to 1950, Owen Gingerich ed., (Cambridge, England: Cambridge University Press, 1984), pp. 124-127.

Gustavus A. Weber, op. cit., pp. 76-78.

H.T. Kirby-Smith, U.S. Observatories: A Directory and Travel Guide (New York: Van Nostrand Reinhold Company, 1976). pp. 19-20.

United States Naval Observatory (Washington, DC.: U.S. Government Printing Office, 1982). pp. 1-3. (Brochure)

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Continuation Sheet

Section number 9 Page 2

Bibliography

Abell, George O. Exploration of the Universe. 4th ed., Philadelphia: Saunders College Publishing, 1982.

Asimov, Isaac. Eyes On The Universe. Boston: Houghton Mifflin Company, 1975.

Baker, Paul R. Richard Morris Hunt. Cambridge: Massachusetts, MIT Press, 1980.

Circular Relating to the Construction of a New Naval Observatory. Washington, D.C.: Navy Department, 1888.

Kirby-Smith, H.T. U.S. Observatories: A Directory and Travel Guide. New York, Van Nostrand Reinhold Company, 1976.

Learner, Richard. Astronomy Through the Telescope. New York: Van Nostrand Reinhold Company, 1981.

Marx, Siegfried, and Werner Pfau, Observatories of the World. New York: Van Nostrand Reinhold Company, 1984.

Rhynsburger, R. W. "A Historic Refractor's 100th Anniversary," Sky and Telescope. October 1973, pp. 2-8.

Schroer, Blanche H., and Steven H. Lewis, "National Register of Historic Places Inventory Nomination Form-Old Naval Observatory." Washington, DC: National Park Service, Historic Sites Survey Division, 1977.

"The New Naval Observatory, Washington, DC." The American Architect and Building News. October-December 1892, pp. 121-122.

United States Naval Observatory Washington, DC, U.S. Government Printing Office, 1982. (Brochure)

Warner, Deborah. "United States Naval Observatory," Astrophysics and twentieth century astronomy to 1950. Owen Gingerich, ed., Cambridge, England: Cambridge University Press, 1984.

Weber, Gustavus. The Naval Observatory: Its History, Activities and Organization. Baltimore: The Johns Hopkins University Press, 1926.

SEE CONTINUATION SHEET

Previous documentation on file (NPS):

- preliminary determination of individual listing (36 CFR 67) has been requested
- previously listed in the National Register
- previously determined eligible by the National Register
- designated a National Historic Landmark
- recorded by Historic American Buildings Survey # _____
- recorded by Historic American Engineering Record # _____

See continuation sheet

Primary location of additional data:

- State historic preservation office
- Other State agency
- Federal agency
- Local government
- University
- Other

Specify repository: _____

10. Geographical Data

Acres of property 19.27 acres

UTM References

A

1	8
3	2
1	0
8	0

4	3
0	9
8	4
0	0

B

1	8
3	2
0	7
6	0

4	3
0	9
5	6
0	0

C

1	8
3	2
0	4
6	0

4	3
0	9
8	4
0	0

D

1	8
3	2
0	7
9	0

4	3
1	0
2	0
0	0

See continuation sheet

Verbal Boundary Description

The boundary of the Naval Observatory is a circle on a radius of 1000 feet centered on Clock Room of the observatory (see attached sheet.)

See continuation sheet

Boundary Justification

This is the legal boundary for the Naval Observatory.

See continuation sheet

11. Form Prepared By

name/title Harry Butowsky
 organization National Park Service date May 1, 1989
 street & number 1100 L Street, NW telephone (202) 343-8155
 city or town Washington state DC zip code 20013



**UNITED STATES
NAVAL
OBSERVATORY**

34th and Massachusetts Ave., NW
Washington, D.C. 20390

MISSION

The U.S. Naval Observatory performs an essential scientific role for the United States, the Navy, and the Department of Defense. Its mission includes determining the positions and motions of the Earth, Sun, Moon, planets, stars, and other celestial objects; providing astronomical data; determining precise time; measuring the Earth's rotation; and maintaining the Master Clock for the United States. Observatory astronomers formulate the theories and conduct the relevant research necessary to improve these mission goals. This astronomical and timing data, essential for accurate navigation and the support of communications on Earth and in space, is vital to the Navy and the Department of Defense. It is also used extensively by other agencies of the government and the public at large.

FUNDAMENTAL ASTROMETRY

Astrometry is that branch of astronomy in which the positions and motions of the Sun, Moon, planets and selected stars are precisely determined. The Observatory is one of the few institutions in the world, and the only one in the United States, at which such fundamental observations are regularly made. The instruments used are the Observatory's transit circle and astrographic telescopes, located in Washington, D.C., Flagstaff, Arizona, and Black Birch, New Zealand.



CELESTIAL MECHANICS

Observatory scientists combine the data from the astrometry programs with the theories of motion of the solar system. They compute the future positions of the Sun, Moon, and planets and make them available, along with star positions, for use by navigators, surveyors, geodesists, and astronomers.

TIME

The Naval Observatory is the source of official time used in the United States. This accurate timekeeping is performed by cesium beam and hydrogen maser clocks. The rate of these atomic clocks is constant to within 1 nanosecond (one billionth of a second) per day. The need for such extreme precision arises from many applications of modern technology, including communications and navigation at sea, in the air, and in space.

PUBLICATIONS

Results of Observatory programs are disseminated through regular series of publications. These include the Nautical, Air, and Astronomical Almanacs, Astronomical Phenomena, the Almanac for Computers, Time Service Announcements, and numerous other aids for the navigator, astronomer, and geodesist. For information concerning these publications, write the U.S. Naval Observatory (Att: AM).

THE LIBRARY

The Observatory's Library contains over 75,000 volumes and is one of the leading astronomical libraries in the world. In addition to its extensive holdings of current scientific publications, the library also serves as an archive for many rare books and periodicals dating back to the 15th century. These include the works of such giants as Newton, Galileo, Kepler, and Copernicus. The library is maintained primarily for the needs of the Observatory's staff, but is also made available for use by other scientific scholars and researchers.

TELESCOPES

The largest telescope located on the Observatory grounds in Washington, D.C., is the historic 26-inch refractor acquired in 1873, when it was the world's largest refractor. This telescope is now used chiefly for planetary satellite observations and for determining the orbital motions and masses of double stars from visual and photographic observations.

The Observatory's largest optical telescope is located at the Flagstaff Station in Arizona. It is the 61-inch astrometric reflector, used to obtain distances of faint objects, and to measure the brightness and colors of stars. (In 1978, while examining photographic plates taken with this telescope, James Christy discovered a moon circling the planet Pluto). With the 61-inch, astronomers have observed 'brown dwarfs', the name given to stars which emit very little light. A 40-inch reflector, also located in Arizona, makes photometric observations. Together with the 26-inch telescope's program of double star work, the observations made by the 61-inch and the 40-inch, and the body of data which they provide, are the essential physical parameters which make all of astrophysics and cosmology possible.



Other telescopes used by the Observatory include: transit circles, used exclusively for astrometry; an 8-inch double astrograph, involved in producing a catalog of faint stars; a 15-inch astrograph, used to obtain the positions of comets and minor planets; two 24-inch reflectors; and a 12-inch refractor. Photographic zenith tube telescopes and radio telescopes at various locations are used for determining astronomical time and the orientation of the Earth in space.

NEW PROGRAMS

The Naval Observatory is involved in many important programs dealing with a wide variety of astronomical topics. In order to monitor the Earth's changing orientation in space, the Observatory participates in a cooperative program with the National Geodetic Survey. Using a 3-station network of radio telescopes located in Florida, Texas and Massachusetts, the faint signals emitted by quasars are collected and recorded for later reduction at the Observatory. Photographic zenith tube telescopes, located in Florida and Washington, and radio telescopes located in West Virginia, are also used to gather the data necessary to monitor changes in the Earth's orientation.

The Observatory is also involved with the testing and observing plans of a new electronic imaging camera for the Hubble Space Telescope, to be placed in orbit by the Space Shuttle. Because this optical telescope will be located above the Earth's atmosphere it will enable astronomers to see objects fifty times fainter, and resolve objects ten times more clearly than with existing optical telescopes.

Currently, the Observatory is conducting a program of observations with its 7-inch transit circle telescope at Black Birch Observatory in New Zealand. This program will improve the knowledge of the positions and motions of southern stars, the majority of which are too far south to be seen from Washington. More information on specific programs can be obtained by writing the Public Affairs Office.





HISTORICAL NOTES

Founded in 1830, and called the Depot of Charts and Instruments, the Naval Observatory is one of the oldest scientific agencies in the country. Its original mission included caring for the Navy's chronometers, charts, and other navigational equipment. In 1844, as its mission evolved and expanded, the Depot was re-established as the U.S. Naval Observatory and was located on the hill north of where the Lincoln Memorial now stands. For nearly 50 years the Observatory remained in this location.

It was during these years that significant scientific studies were carried out, such as speed-of-light measurements, and the Solar Eclipse and Transit of Venus expeditions. Remarkable events took place during these years, too, such as the discovery in 1877 of the two satellites of Mars by Asaph Hall, using the 26-inch telescope.

In 1893, the Observatory was moved to its present site, into buildings designed by the famed 19th century American architect, Richard Morris Hunt. The old Observatory buildings in Foggy Bottom were declared National Historic Monuments in 1966.

TOURS

Free nighttime tours are given at specific times throughout the year. Nighttime tours include observations through telescopes, and discussions with staff astronomers. Telescopes are not open to the public during the day or when skies are cloudy. There is no planetarium at the Observatory. Groups of 15 or more should call to make reservations. Please write or call for tour dates and times.

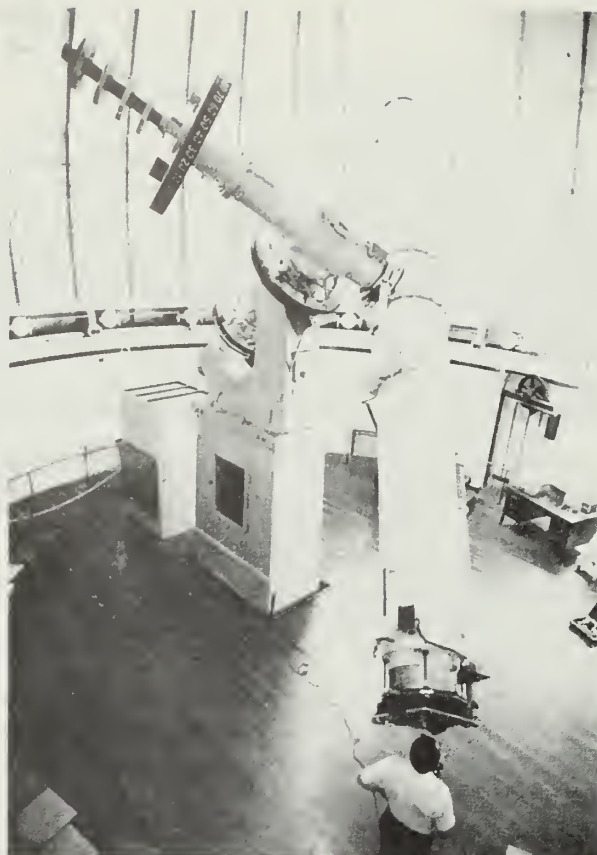
PHONE NUMBERS

General Information & Referral:	202/653-1507
Tour Information:	202/653-1543
Precise Time:	202/653-1800

(Commercially, Precise Time is also available by dialing 900/410-TIME for which the phone company charges \$.50/1 min; \$.35 each add. min.)



THE 26" REFRACTING TELESCOPE



The 26" refracting telescope is the largest telescope at the Washington site of the Naval Observatory. The objective lens at the front of the telescope is 26" in diameter. This lens receives light from the object being observed and brings it to a focus at the observing end 32 1/2' away.

The 26" refractor is primarily used for observing multiple star systems. One of two instruments is placed at the observing end, either a micrometer for making visual observations, or a camera, for making photographic observations.

The equatorial mounting of the telescope together with an accurate driving mechanism allow the telescope to compensate for the rotation of the earth, and follow celestial objects as they move across the sky.

The dome is 45' in diameter and can be rotated so that the shutter opening is exposed to the desired portion of the sky. The floor weighs over 24 tons and can be raised or lowered to accommodate the observer to the telescope.

Construction of the 26" refractor was first suggested by Simon Newcomb in the annual reports of 1868 and 1869 which he submitted to the superintendent of the Naval Observatory, Adm. Benjamin F. Sands. The impetus stemmed from Alvan Clark's completion, just prior to the Civil War, of an 18 1/2" refractor, then the largest of its kind. Also, in 1862 and 1863 Clark had demonstrated his unique talents by the extremely successful refiguring of the lenses for some of the Naval Observatory's earlier instruments.

In July 1870, the superintendent of the Naval Observatory "contracted for the construction of a refracting telescope of the largest size, of American manufacture, at a cost not exceeding fifty thousand dollars." Newcomb negotiated the contract with Clark and Sons in August, 1870. In 1871 the superintendent requested \$10,000 for the tower and dome to house the refractor. This construction was completed in October, 1873, in time to receive the finished telescope.

-MORE-

Regular observing began on November 20, 1873, with measures of the separations and position angles of the satellites of Uranus and Neptune. The first observation was of Triton, the only moon of Neptune known at the time. These planets' large distances made accurate determinations of their masses from studies of their satellites very difficult; hence, investigations of this nature were made the first great work of the telescope. Although its principal use was observing the satellite systems of the outer planets, on many occasions during those early years close double stars were observed and studies made of nebulae, such as the Omega, Orion, and Trifid.

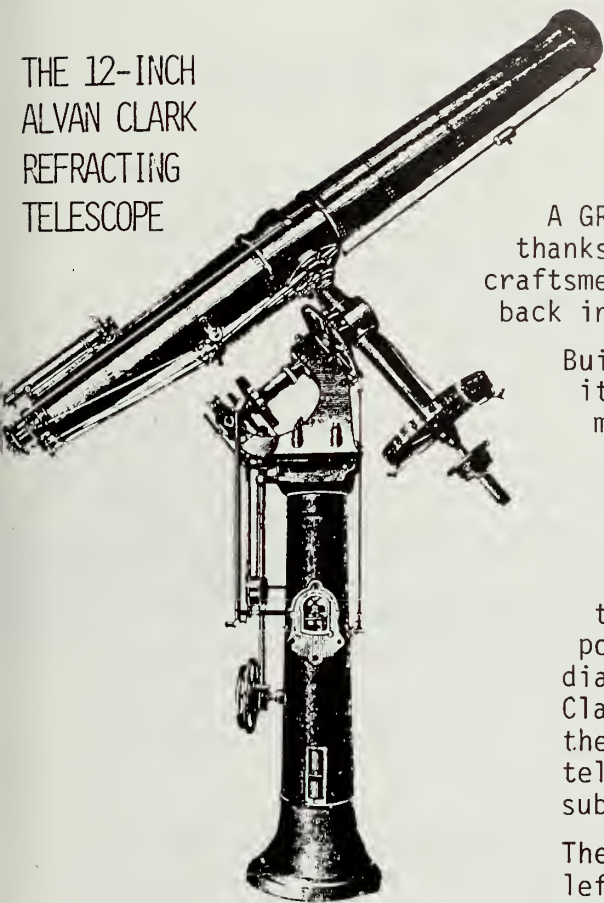
On June 16, 1875, Asaph Hall was placed in charge of the 26", relieving Newcomb (who two years later became superintendent of the Nautical Almanac Office). This led to what was perhaps the most outstanding event in the history of the 26": the discovery of the two moons of Mars. Observing alone on August 11, 1877, Hall found Deimos, the outer moon, and six days later he and assistant George Anderson first detected the inner moon, Phobos. Observed through October, the satellites could not be seen in November and were not found again until Mars' next opposition.

Although the 26" refractor had always been used for visual observations of double stars, in 1949-52 William Markowitz demonstrated that there were still a sufficient number of nights in Washington with seeing conditions favorable for measuring close binaries-with separations that are well under one second of arc. Charles Worley recommended the visual close binary program in late 1961 and this long-range program has been continued to the present. With the micrometer digitized, the speed of an observation is nearly doubled, while reading errors are eliminated entirely. Over the past 20 years more than 20,000 visual observations of double stars have been made, whereas during the telescope's first 80 years this number did not quite attain 10,000.

The second primary program since the renovation is photographic observations of double stars. A multiple-exposure camera with automatic timing and plate control permits using observing procedures first developed by Ejnar Hertzsprung. To compensate for differences of magnitude between components, objective gratings are available to produce a difference of 1/2, 1, 2, 3, 4, or 6 magnitudes between the central image and the 1st-order spectral images. An additional grating, providing a 9.8-magnitude difference, is used in the study of the motion of the faint companion of Sirius.

The 26" has been used for numerous observations of comets, asteroids, planetary features, novae, and occultations during the last three decades. In the mid-1950's John S. Hall and W. A. Baum conducted their image-tube experiments with it. Also, on the average of three times a month near first-quarter moon, the instrument shows some of the 5,000 annual nighttime visitors interesting celestial objects.

THE 12-INCH
ALVAN CLARK
REFRACTING
TELESCOPE



U. S. NAVAL OBSERVATORY

A GRAND OLD OBSERVER OF THE HEAVENS has a second life, thanks to the diligent work of volunteer scientists and craftsmen. The Alvan Clark 12-inch refracting telescope is back in its original dome at the U. S. Naval Observatory.

Built in 1892 by G. N. Saegmuller of Washington, D. C., it was fitted in 1895 with a 12-inch objective lens made by Alvan Clark of Cambridge, Massachusetts.

(Focal length: 180.6 inches. Focal ratio: f/15. Guide scope by John Clacy: 4.5 inch; f/10). The original "star dials" for direct mechanical indication of right ascension and declination were designed by William Harkness, Astronomical Director of the Naval Observatory. These were used to precisely point the telescope to the desired star. These "star dials" have long since disappeared, but the 12-inch Clark refractor may have been the first telescope in the world to be so equipped. The 12-inch Saegmuller telescope still in use at Georgetown University was subsequently fitted with dials of the same design.

The engraving of the 12-inch Clark refractor (seen at left) was taken from a book on astronomical instruments published in Germany in 1899. It shows the telescope as it looked originally in the rooftop dome of the Naval Observatory.

In 1957, the 12-inch telescope was put in storage in order to make room for a special telescope used to determine the position of the moon (the Markowitz Moon Camera). Five years later, the 12-inch refractor was hauled out of storage and mounted in another dome on the grounds (now housing the 24-inch reflector). It was used to observe double stars until 1971. Parts of the telescope were then boxed in crates and stored outdoors, suffering damage from exposure until 1980, when two determined astronomers decided to attempt to restore it.

"Several parts were heavily corroded by exposure," said astronomer Ted Rafferty, "but we felt confident they could be restored individually and reassembled."

During reconstruction, astronomer volunteers and staff members used original blueprints from the 1890s to assist in duplicating the original telescope design. One faded photograph from 1906 also supplied some guidance to the restoration committee.

When restoration was complete, a crane hoisted the 2,000 pound telescope base 85 feet above the Observatory's main building. With only 2 inches to spare, the base was piloted through the 27-inch slit in the Observatory dome.

"The refractor is an authentic astronomical instrument of the 19th century," said astronomer Richard Schmidt. "We were interested in rescuing a tangible piece of the Observatory's history."

With more than 700 hours of volunteer work behind them, the restoration committee is understandably proud of its accomplishment. The gleaming brass and new paint are testimony to the splendid restoration task. The 1895 12-inch refractor is now equipped with both the original and modern eyepieces, and planetary, nebular and solar filters. It is maintained by the U. S. Naval Observatory's History Committee. It is used on public tours, and for personal staff observing.

SOLAR OBSERVING IN HYDROGEN-ALPHA LIGHT

The Sun is our nearest star, and the only one close enough for easy observation of the magnetic storms and brilliant flares of its active and ever-changing face.

The surface of the Sun that we see in natural "white" light is called the PHOTOSPHERE. This thin layer is the source of the greatest amount of energy output of the Sun. Here SUNSPOTS and the bright, hot regions called FACULAE are seen. Solar GRANULATION looking like rice pudding occurs just below the photosphere, where bubbles of hot gas reach the surface.

The solar CHROMOSPHERE is a tenuous atmospheric region lying up to 20,000 km above the photosphere. Here temperatures rise from below 5,000 degrees at the base of the chromosphere, to over one million degrees at the top. Some of the most interesting active solar phenomena take place in this layer of the Sun, but the powerful white light of the photosphere outshines the delicate features of the chromosphere. Fortunately, there are ways to block out the bright white light of the photosphere. A precise SPECTROSCOPE can be used to separate the natural sunlight into its many-colored components, and those colors that originate in the chromosphere can be singled out. Recently low-cost optical filters have been perfected that allow the observer to block out all but a very small part of the total solar light spectrum. These NARROW-BAND FILTERS can look at a very narrow range of color (wavelength of light). In the case of the solar chromosphere, atomic processes cause very strong light output in a narrow band of light known as the HYDROGEN-ALPHA LINE. It lies in the red part of the solar spectrum and its characteristic color is very evident at the telescope.

At the U.S. Naval Observatory the Sun is observed using a special narrow-band filter on the 12-inch refractor that is tuned to the hydrogen-alpha line. Viewed through this filter, the chromosphere displays irregular bright and dark features called PLAGES, FILAMENTS, and SPICULES, with an underlying patchwork pattern over the solar disk known as the CHROMOSPHERIC NETWORK.

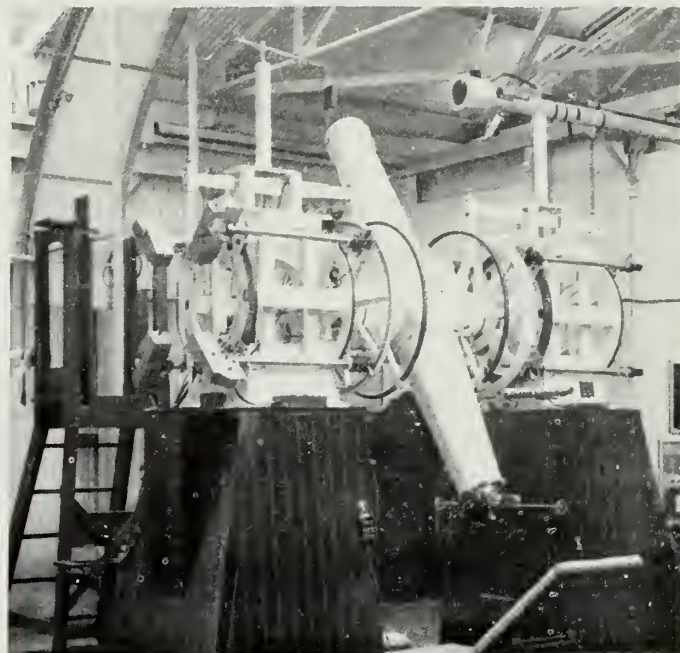
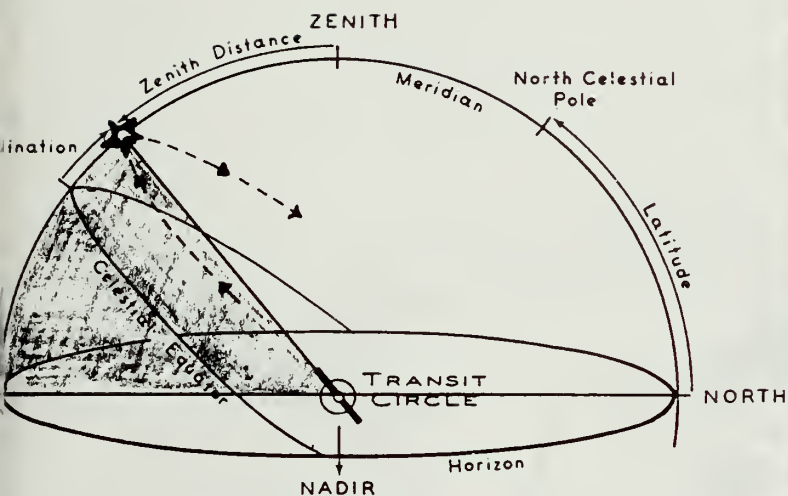
PLAGES appear as bright concentrations on the chromospheric network, regions of higher density and temperature than the surrounding area. Glowing jets ceaselessly rising and falling, SPICULES are areas of high magnetic fields forming boundaries between the SUPERGRANULES of the chromospheric network. They are seen in Hydrogen-alpha light both as bright points on the Sun's limb and as dark grains on the disk. PROMINENCES are spectacular streams of chromospheric hydrogen rising tens of thousands of kilometers high into the solar CORONA. They are of two general types, QUIESCENT PROMINENCES lasting weeks and falling slowly back to the chromosphere and ACTIVE PROMINENCES appearing rapidly and decaying within hours. At the telescope prominences resemble red flames leaping off the edge of the Sun, although one must observe for many minutes to see any motion.

Both spicules and prominences are related to the development of SOLAR FLARES, unpredictable outbursts of fantastic quantities of energy that radiate along the spectrum from X-rays to kilometer wavelength radio and produce high-energy solar cosmic ray particles that reach the upper atmosphere of the Earth within a half hour, and could be hazardous to space travellers. In hydrogen-alpha light flares begin as small, starlike bright points on a plage that spread out within minutes and remain bright for up to a few hours. Energy output can equal that of a billion megaton bomb!

Many of these features of the solar chromosphere may be visible as you observe the Sun with the 12-inch refractor. Unfortunately, at times the Sun is rather inactive, and there may happen to be no spectacular prominences or flares visible. And all observing is halted by cloudy weather!

The U.S. Naval Observatory's solar observing system is a safe and widely used method for exploring the Sun. But extreme caution must be taken in any solar observing system one might set up at home, as the powerful light of the Sun can cause permanent eye damage if improperly viewed.

THE U.S. NAVAL OBSERVATORY SIX-INCH TRANSIT CIRCLE TELESCOPE



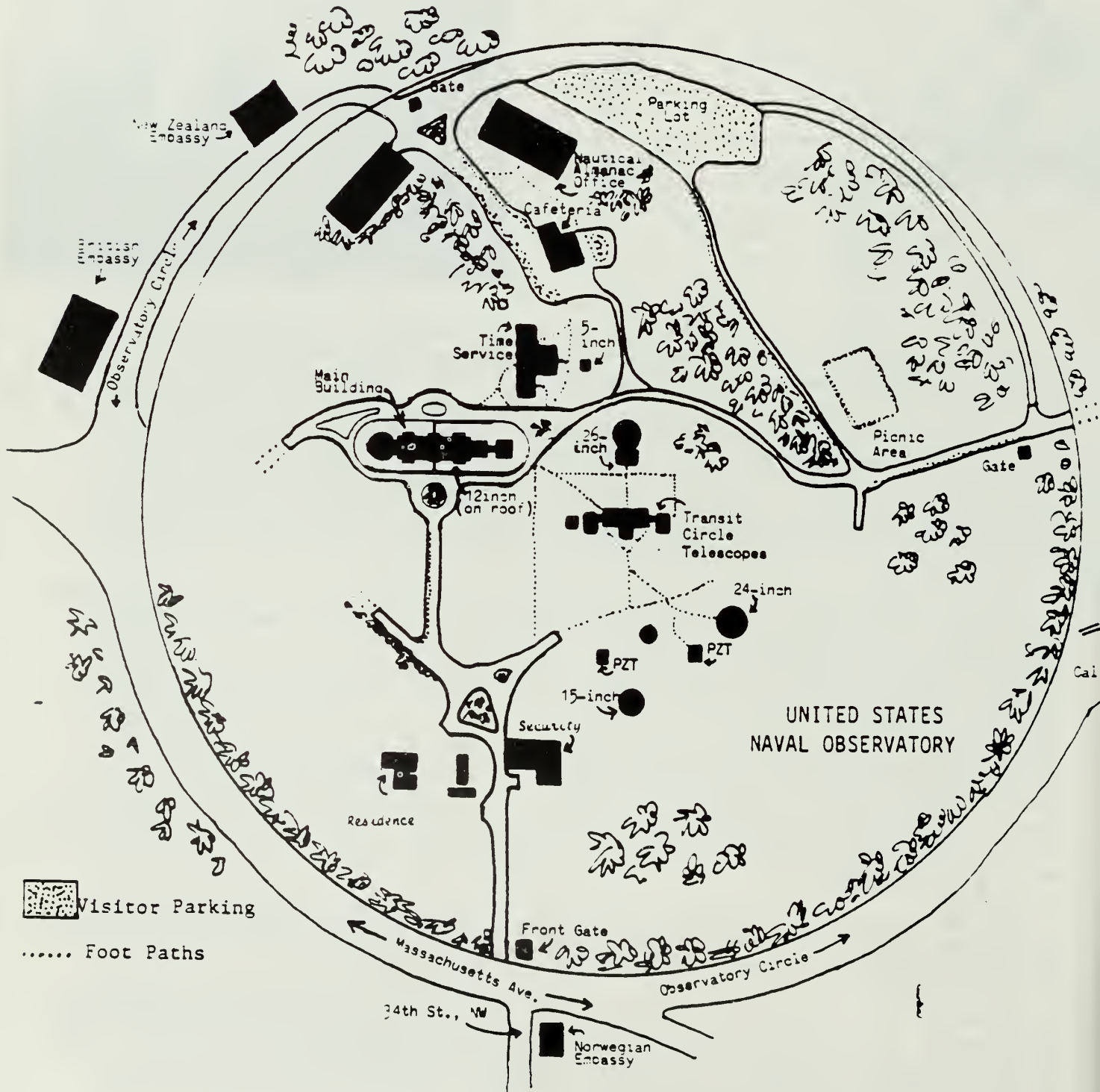
An important aspect of astronomy is the determination of a fundamental celestial coordinate system. Only by determining the small movements of the stars can a reference system be established for various purposes, such as predicting the motions of the Sun, Moon, and planets. At the present time the only instrument that can successfully determine this coordinate system is the transit circle, a specialized telescope that can be moved only along the meridian, a north-south arc passing through the observer's zenith. This restriction of motion, together with the massive concrete piers on which the telescope is mounted, provides the stability that is the first requirement for the precise and accurate determination of the positions of celestial bodies.

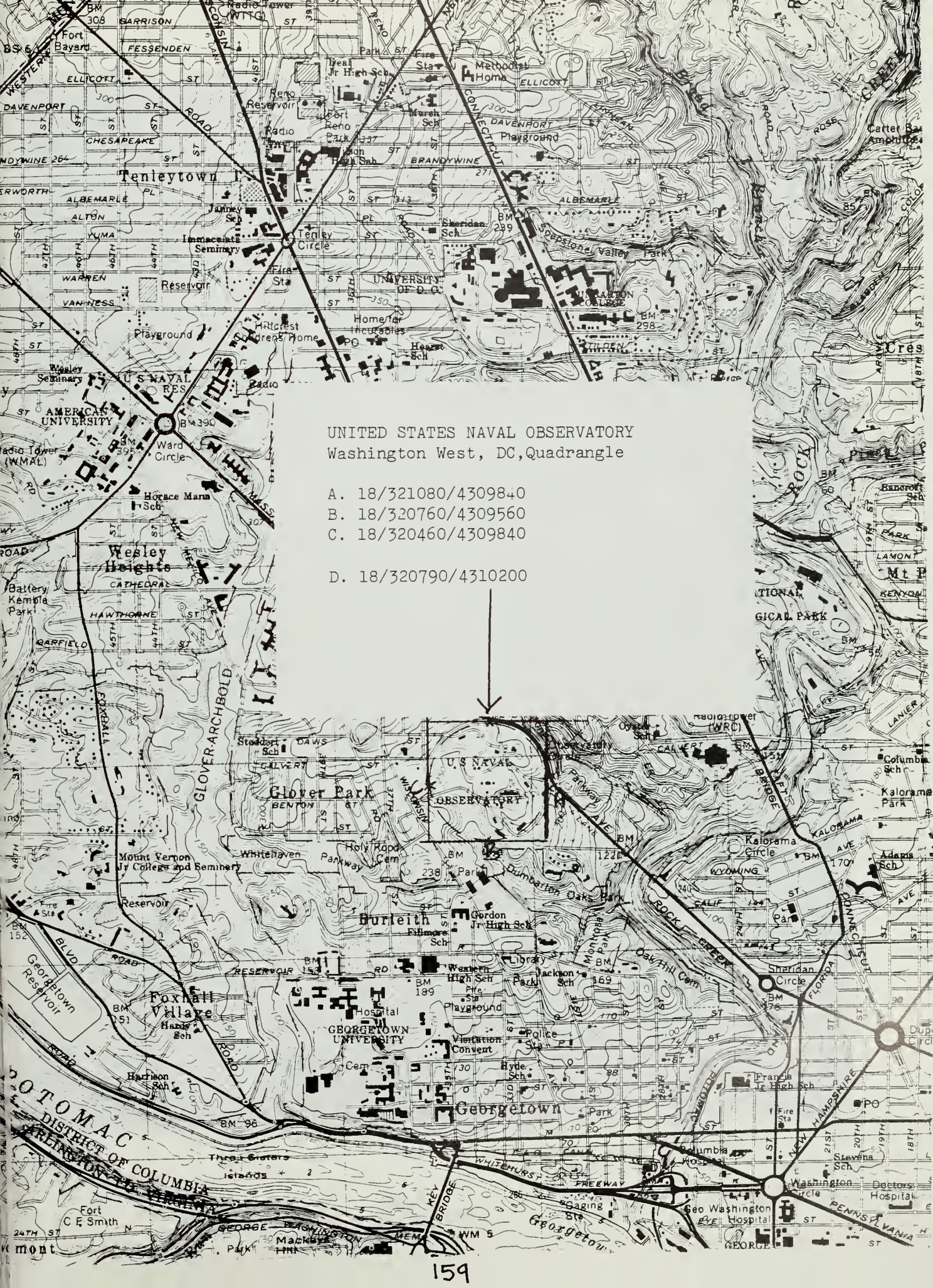
The six-inch transit circle telescope is so named because its lens is six inches in diameter, and because the east-west coordinate (the right ascension) of a star is measured by timing when it crosses, or "transits", the meridian due to the Earth's rotation, while the north-south coordinate (the declination) is measured with a very finely divided circle. In both coordinates precise measurements are made with respect to a system of wires placed in the focal plane of the eyepiece. The astronomer views these wires through the eyepiece and tracks the star with respect to them. These measurements, accurate to a few hundredths of a second of time, are immediately recorded by a computer for later analysis. After many observations a catalogue of star positions is produced, and in addition the positions of solar system objects are forwarded to the Nautical Almanac Office at the Observatory, where predictions are made of future positions.

Weather permitting, observations are made 24 hours a day throughout the year. During the daylight hours, the Sun, Mercury, Venus, and bright stars can be observed. Over a 24 hour period several hundred objects can be observed.

Although more than 80 years old, the six-inch transit circle is being constantly improved by the use of new engineering and scientific developments. The only other functioning transit circle in the United States is an eight-inch instrument at the Naval Observatory station in Flagstaff, Arizona. The Naval Observatory is also currently developing a seven-inch photoelectric transit circle for a Southern hemisphere observing program in New Zealand.

NAVAL OBSERVATORY





UNITED STATES NAVAL OBSERVATORY
Washington West, DC, Quadrangle

- A. 18/321080/4309840
- B. 18/320760/4309560
- C. 18/320460/4309840
- D. 18/320790/4310200



United States Naval Observatory — Washington, DC
Aerial View of the observatory circle, 1950

Photo Credit: United States Naval Observatory



United States Naval Observatory — Washington, DC
Exterior View of the James Melville Gilliss building, 1988

Photo Credit: United States Naval Observatory



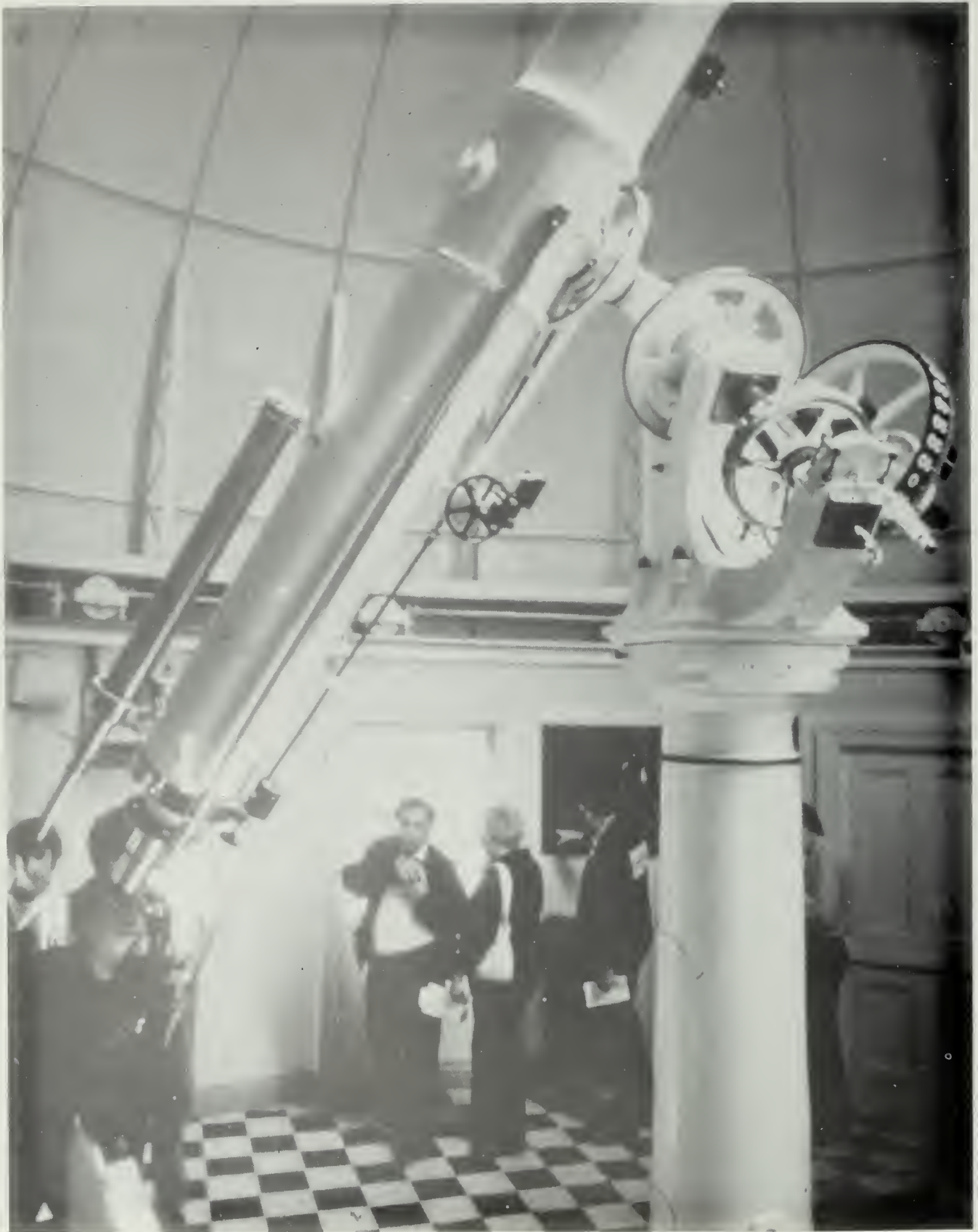
United States Naval Observatory — Washington, DC
Exterior View of Asaph Hall, 1938

Photo Credit: United States Naval Observatory



United States Naval Observatory — Washington, DC
26-inch Alvan Clark refractor

Photo Credit: United States Naval Observatory



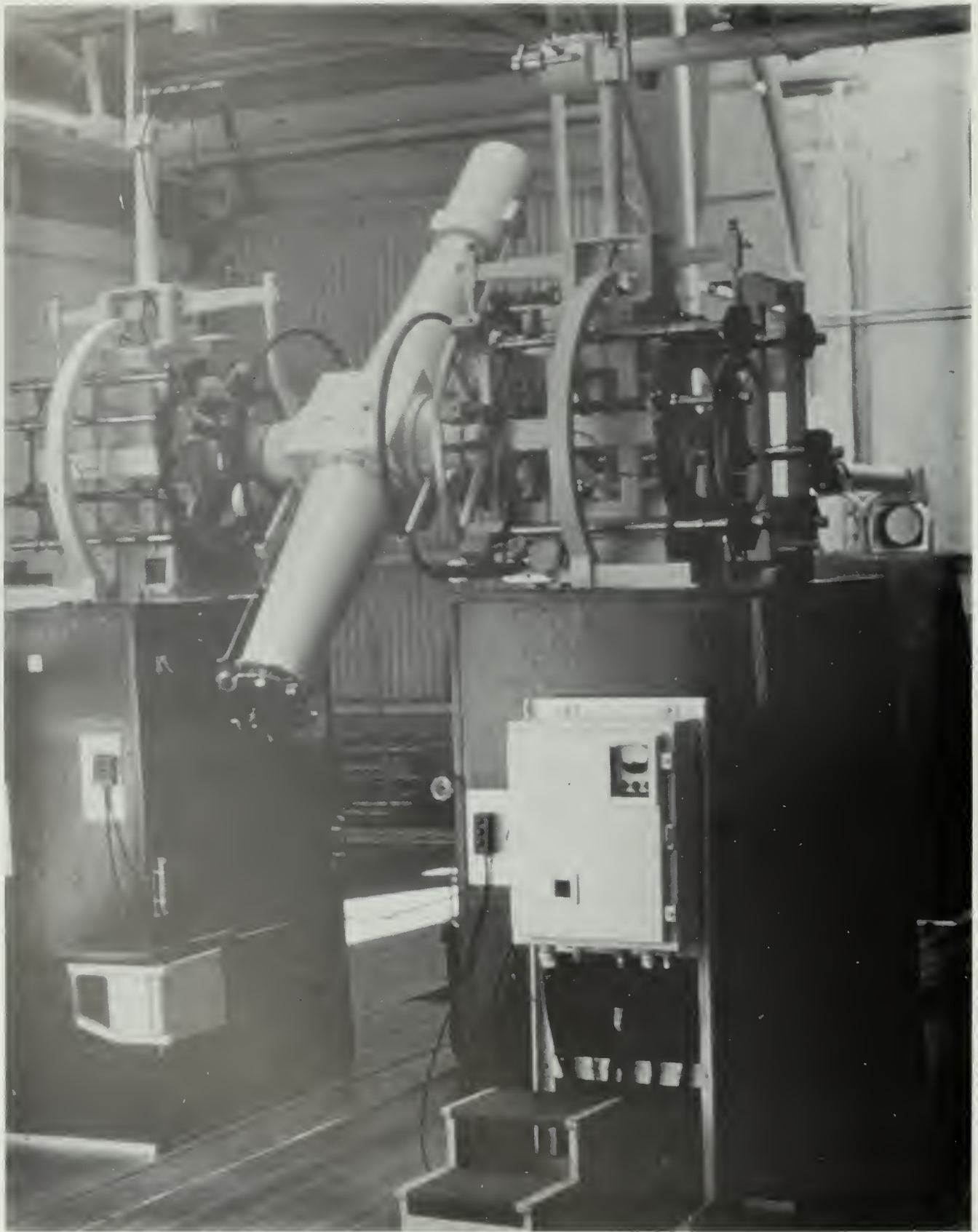
United States Naval Observatory — Washington, DC
12-inch Alvan Clark refractor, 1988

Photo Credit: United States Naval Observatory



United States Naval Observatory — Washington, DC
Exterior View of the West Transit Circle building, 1988

Photo Credit: United States Naval Observatory



United States Naval Observatory — Washington, DC
6-inch meridian transit circle telescope, 1988

Photo Credit: United States Naval Observatory



United States Naval Observatory — Washington, DC
Superintendent's House (now used as the official residence of the Vice-President), circa 1970

Photo Credit: United States Naval Observatory

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name University of Illinois Observatory
other names/site number _____

2. Location

street & number 901 South Mathews Avenue not for publication
city, town Urbana vicinity
state Illinois code IL county Champaign code 019 zip code 61801

3. Classification

Ownership of Property	Category of Property	Number of Resources within Property	
<input type="checkbox"/> private	<input checked="" type="checkbox"/> building(s)	Contributing	Noncontributing
<input type="checkbox"/> public-local	<input type="checkbox"/> district	_____	_____ buildings
<input checked="" type="checkbox"/> public-State	<input type="checkbox"/> site	_____	_____ sites
<input type="checkbox"/> public-Federal	<input type="checkbox"/> structure	_____	_____ structures
	<input type="checkbox"/> object	_____	_____ objects
		<u>1</u>	_____ Total

Name of related multiple property listing: _____
Number of contributing resources previously listed in the National Register 0

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of certifying official _____ Date _____

State or Federal agency and bureau _____

In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of commenting or other official _____ Date _____

State or Federal agency and bureau _____

5. National Park Service Certification

I, hereby, certify that this property is:

- entered in the National Register. See continuation sheet. _____
- determined eligible for the National Register. See continuation sheet. _____
- determined not eligible for the National Register. _____
- removed from the National Register. _____
- other, (explain:) _____

Signature of the Keeper _____

Date of Action _____

6. Function or Use

Historic Functions (enter categories from instructions)

Education

Research Facility

Current Functions (enter categories from instructions)

Education

Research Facility

7. Description

Architectural Classification

(enter categories from instructions)

No style

Materials (enter categories from instructions)

foundation concrete

walls brick

roof copper

other

Describe present and historic physical appearance.

The history of the University of Illinois Observatory dates to 1895 when the Illinois state legislature voted the sum of fifteen thousand dollars for the construction of a new observatory on the grassy knoll between Matthews Avenue and Burrill Avenue in Urbana, Illinois. The site is just north of the 1876 Morrow Plots, the nation's oldest experimental field, and a National Historic Landmark. The structure was built to replace a smaller observatory located farther north and west, closer to the heart of campus.¹

Contracts were let in the early spring of 1896 and ground was broken in April of that year. The architect was Charles A. Gunn; Bevis and Company of Urbana was the general contractor. Ira Baker, a professor of civil engineering, served as the supervisor of construction while George Meyers, first director of the observatory, was in Europe.

The building was constructed on a one-story T plan, facing north. It is of buff-colored Roman brick (manufactured in Indiana), with limestone lintels and sills. The bar of the T is 75 feet long east to west and 25 feet deep. The stem of the T is located to the south, centered along the the east-west axis and is 26 feet deep by 25 feet wide. The octagonal observation tower rises to a height of 25 feet at the intersection of the T and then becomes round, continuing to a total height of 35 feet. At the floor level of the second equatorial room, a balustrade circles around the exterior of the tower on the north, east, and west.

The tower is capped by a great hand-tooled, circular, limestone plate which carries the dome track. The internal diameter of the dome is 24.5 feet and at its apex is 24 feet above the equatorial room floor. The operable slit has a clear opening of 44 inches and is opened and closed by hand in a matter of seconds. The dome tower and equatorial room are original with the exception of a motor drive which replaced the rope and sheave method of rotating the dome on its metal track.

 See continuation sheet

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 7 Page 2

At the center of the equatorial room is located the 1896, 12-inch refractor telescope. The telescope was made by the firm of Warner and Swasey of Cleveland, Ohio. For maximum stability it is mounted on a brick pier which extends down to bedrock and is not attached to the building in any way. The telescope was obtained at a cost of \$4,500. Also original is the observer's chair; it was included in the original contract for the building and equipment and was built by Bevis and Company at a cost of \$25.

The octagonal entrance hall below the equatorial room is centered around the massive brick pier. The interiors of the load-bearing brick walls are painted white. Other non-bearing walls are of four-inch tongue and groove head board. This room continues to be used for its original purpose--storage of portable equipment, books, etc. The original stairs, newel posts, balustrades and wood floors are extant.

Originally, there were two transit rooms in each of the east and west wings. Each room had a permanently mounted transit telescope on a brick pier. The windows drop into pockets in the basement wall to allow for unobstructed observing from these locations. The transit rooms have since been converted to office space, as has the southern classroom wing. The brick piers are still visible in the basement beneath the transit rooms.

The exterior is ornamented by a brick cornice, stone sills and lintels, stone water course, ornamental gutters, and original copper downspouts. Most windows are original wood, double hung. The central front entrance door with transom and concrete stoop is original. While the original front balustrade has been replaced, the western stoop and ornamental iron balustrade is intact.

Although the transit rooms are no longer used for their original purpose, the primary alteration to the building has been two single story additions, one located in the southwest corner and the other being the large wing on the east.

The first addition was of light cream-colored brick and was nestled into the southwest corner of the building to provide additional classroom and office space in 1956. The addition replicates the original structure in scale, rhythm, detail, and materials in essentially every way except color. Care was taken to match the cornice lines, gutters, stone lintels, sills, and watercourse. The brick is of the same size, and its configuration attempts to match the narrow mortar joints of the earlier building. Likewise, the large east wing, constructed in 1966, is of the same light cream-colored brick and replicates the aforementioned detail. The scale of this later addition is much larger than either of the two previous components. This addition provided more office space, a new dark room and a radio telescope laboratory.

**United States Department of the Interior
National Park Service**

**National Register of Historic Places
Continuation Sheet**

Section number 7 Page 3

The basement of the observatory and the dome housing the 12-inch refractor are still used by the astronomy department of the University of Illinois. The remaining rooms are now used to house various administrative offices of the University.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

nationally statewide locally

Applicable National Register Criteria A B C D NHL Criteria 1

Criteria Considerations (Exceptions) A B C D E F G

Areas of Significance (enter categories from instructions)

National Register

Education, Engineering, Science

National Historic Landmark:

Science, Subtheme: Physical Science,

Facet: Astronomy

Period of Significance

1907-1922

Significant Dates

Cultural Affiliation

Significant Person

Joel Stebbins

Architect/Builder

Charles Gunn

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

Summary

The University of Illinois Observatory is significant because of its association with the development of the selenium photoelectric cell which revolutionized the science of astronomical photoelectric photometry--the measurement of celestial magnitudes. The research was conducted on the 12-inch Warner and Swasey refractor telescope located in the second story equatorial room of the 1896 brick observatory. The development of the selenium cell was done by Joel Stebbins (1878-1966), in the years from 1907 to 1922, while he was the director of the University of Illinois Observatory. As a result of Stebbins' work at Illinois with the photoelectric cell, photoelectric photometry became the standard technique in determining stellar magnitudes. The determination of stellar magnitudes is one of the most fundamental measurements in the field of astronomy.

History

Prior to 1907 all measurements of the magnitude of stars were obtained by visual comparison of relative brightness--a slow, cumbersome and inexact process at best. Later, photographic methods used starlight to make a representation on a photographic plate. Neither method was adequate for quantitative measurements, as they provided only the most rudimentary comparisons. Because of these drawbacks, the use of electricity for empirically gathering astronomical data revolutionized the field of astronomy. The man responsible for this development is Joel Stebbins who did his pioneering research in the field of astronomical photometry during the period from 1907 to 1922 while he was director at the Illinois Observatory.²

Stebbins arrived as director of the observatory after completing his Ph.D. at the University of California, Berkeley, in 1903. For the next few years he conducted research into the relative brightness of binary stars, using visual and photographic techniques. Stebbins was assisted in his efforts by his wife, May, who frequently acted as recorder. In a speech

See continuation sheet

United States Department of the Interior
National Park ServiceNational Register of Historic Places
Continuation SheetSection number 8 Page 2

before the American Astronomical Society in 1957 Stebbins recalled the events which led up to the electric cells:

She (May Stebbins) wrote down the numbers as the observer called them, but after some nights of recording a hundred readings just to get one magnitude, she said it was pretty slow business. I responded that someday we would do all this by electricity. That was a fatal remark. Thereafter she would often prod me with the question, "When are you going to change to electricity?" It happened that within two or three months, the Department of Physics gave an open house, and one of the exhibits was in charge of a young instructor, F.C. Brown. He showed how, when he turned on a lamp to illuminate a selenium cell, a bell would ring, when the lamp was off, the bell would stop. Here was the idea: Why not turn on a star to a cell on a telescope and measure a current?³

Stebbins soon made friends with Brown and in due time they had a selenium cell positioned on the 12-inch refractor telescope. In the fall of 1907 after some trial and error, the two achieved a light curve for the moon.

This successful use of photoelectric technology was a quantum leap in the field of astronomy. Stebbins later discovered that cooling the cell to zero degrees Fahrenheit doubled the sensitivity and diminished the irregularities in the circuit tenfold. Likewise, by reducing the size of the cell, irregularities were again reduced. Brown and Stebbins went on to detect stellar intensity and activity that were previously unrecorded.

Stebbins continued to do pioneering work with the selenium cell until 1913 when he became associated with Jacob Kunz. Kunz was a University of Illinois physics professor who had been doing experimentation on an improved photoelectric cell which was based on the alkali metals. This cell was the predecessor of the modern-day "electric eye." Its applications in science and industry have been widespread, including early uses in talking motion pictures, television, and aviation. The improved technology of the photoelectric cells over the selenium type had the advantage of greater sensitivity and faster operation. Stebbins explained it in this way:

Only recently we managed to produce a cell which is twice as sensitive as anything we had before, and this amounts to the same thing as though some good fairy had suddenly doubled the light gathering power of our telescope.⁴

United States Department of the Interior
National Park ServiceNational Register of Historic Places
Continuation SheetSection number 8 Page 3

The results were precise light curves of eclipsing double stars, which permitted the determination of the diameters and masses of stars with a higher accuracy than previously attained, and the discovery of previously undetected eclipses in several stars such as Beta Aurigae and Delta Orionis.⁵

Through his work with Stebbins, Kunz continued to refine his cells. This owed largely to the fact that starlight is one of the faintest of all light sources. Kunz's cells were the most sought after in the country, being more than a million times more sensitive than cells commercially available.⁶ This dedication earned him recognition as the "father of the photoelectric cell."⁷ Because of his close collaboration with Kunz, Stebbins usually got the best cells for himself, leaving those of second best quality to other observatories.

Stebbins left the University of Illinois in 1922 to take over the directorship of the Washburn Observatory at the University of Wisconsin. Stebbins replaced his mentor, George C. Comstock, with whom he had studied as a graduate student some 25 years before. Stebbins went on to apply the techniques he had developed while at Illinois. Constant experimentation led to consistently improved technology for the study of astronomy.

The early research done at the University of Illinois Astronomical Observatory was vitally important in the field of astronomy. It transformed the measurement of astronomical radiation from imprecise visual and photographic methods, to a linear quantifiable science. Without this research, modern photoelectric astronomy would not have been possible.

United States Department of the Interior
National Park Service

**National Register of Historic Places
Continuation Sheet**

Section number 8 Page 4

Footnotes

1. Most of the material in this form was adapted from the following source:
Shauna J. Francissen, "National Register of Historic Places Inventory-Nomination Form-University of Illinois Astronomical Observatory" (Urbana, Illinois: Preservation and Conservation Association, 1986).
2. Otto Struve and Velta Zebergs, Astronomy of the Twentieth Century (New York: Macmillan, 1962), p. 80.
3. Joel Stebbins, "Early Photometry at Illinois," Publications of the Astronomical Society of the Pacific, December 1957, p. 506.
4. Joel Stebbins, "The Electrical Photometry of Stars," Science June 14, 1915, p. 811.
5. A.E. Whitford, "American Pioneer in Photoelectric Astronomy," Sky and Telescope May 1966, p. 266.
6. Joel Stebbins, "Jacob Kunz, 1874-1938," Popular Astronomy March 1939, p. 15.
7. "Jacob Kunz, on U. of I. Faculty 29 Years, Dies," The Evening Courier (Urbana, IL.), July 19, 1938, n.p.

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National Park Service

National Register of Historic Places
Continuation Sheet

Section number 9 Page 2

Bibliography

Francissen, Shauna J. "National Register of Historic Places Inventory-Nomination Form-University of Illinois Astronomical Observatory." Urbana, Illinois: Preservation and Conservation Association, 1986.

Myers, G.W. "The Astronomical Observatory at the University of Illinois." Popular Astronomy, 6 (1898).

Stebbins, Joel, and F.C. Brown. "Determination of the Moon's Light with a Selenium Photometer," Astronomical Journal December 1907.

Stebbins, Joel. "Early Photometry at Illinois" Publications of the Astronomical Society of the Pacific, December 1957.

_____. "Jacob Kunz, 1874-1938," Popular Astronomy, March 1939.

_____. "The Brightness of Halley's Comet as Measured With a Selenium Photometer," Astrophysical Journal, July 1910.

_____. "The Electrical Photometry of Stars," Science, June 14, 1915.

Struve, Otto, and Velta Zebergs. Astronomy of the Twentieth Century. New York: Macmillan, 1962.

Svec, Michael T. The University of Illinois Astronomical Observatory. Urbana, Illinois: 1988.

University of Illinois Archives, Observatory file, Urbana, Illinois.

Warner and Swasey. A Few Astronomical Instruments. Cleveland, 1900.

Whitford, A.E. "American Pioneer in Photoelectric Photometry," Sky and Telescope, May 1966.

See Continuation Sheet

Previous documentation on file (NPS):

- preliminary determination of individual listing (36 CFR 67) has been requested
- previously listed in the National Register
- previously determined eligible by the National Register
- designated a National Historic Landmark
- recorded by Historic American Buildings Survey # _____
- recorded by Historic American Engineering Record # _____

See continuation sheet

Primary location of additional data:

- State historic preservation office
- Other State agency
- Federal agency
- Local government
- University
- Other

Specify repository: _____

10. Geographical Data

Acres of property .92

UTM References

A

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 Zone Easting Northing

B

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 Zone Easting Northing

C

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D

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See continuation sheet

Verbal Boundary Description

The boundary follows the outside perimeter of the observatory building.

See continuation sheet

Boundary Justification

The boundary includes only the observatory building since it alone encompasses the site and facilities contributing to the national significance of the resource.

See continuation sheet

11. Form Prepared By

name/title Harry Butowsky
 organization National Park Service date May 1, 1989
 street & number 1100 L Street, NW telephone (202) 343-8155
 city or town Washington state DC zip code 20011

UNIVERSITY OF ILLINOIS OBSERVATORY

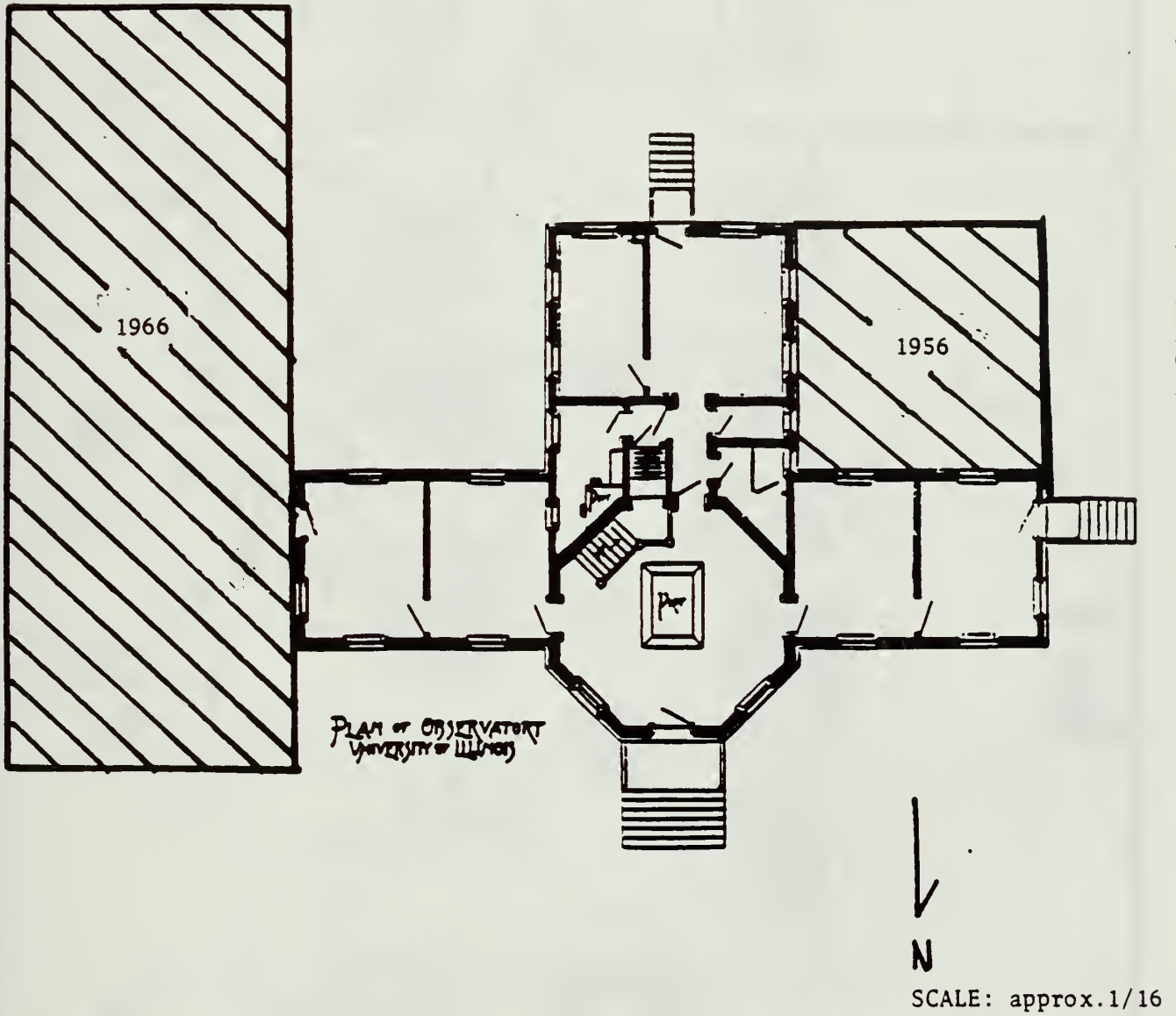
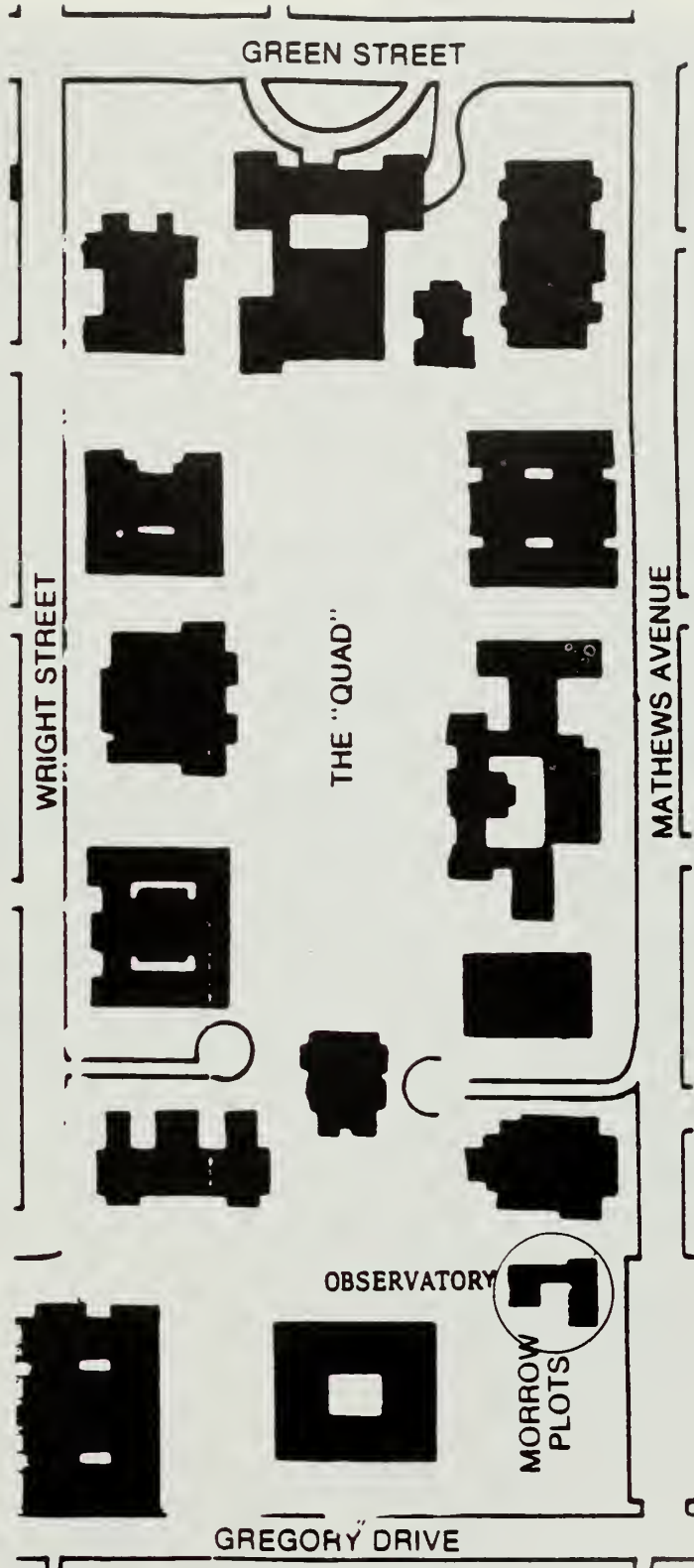


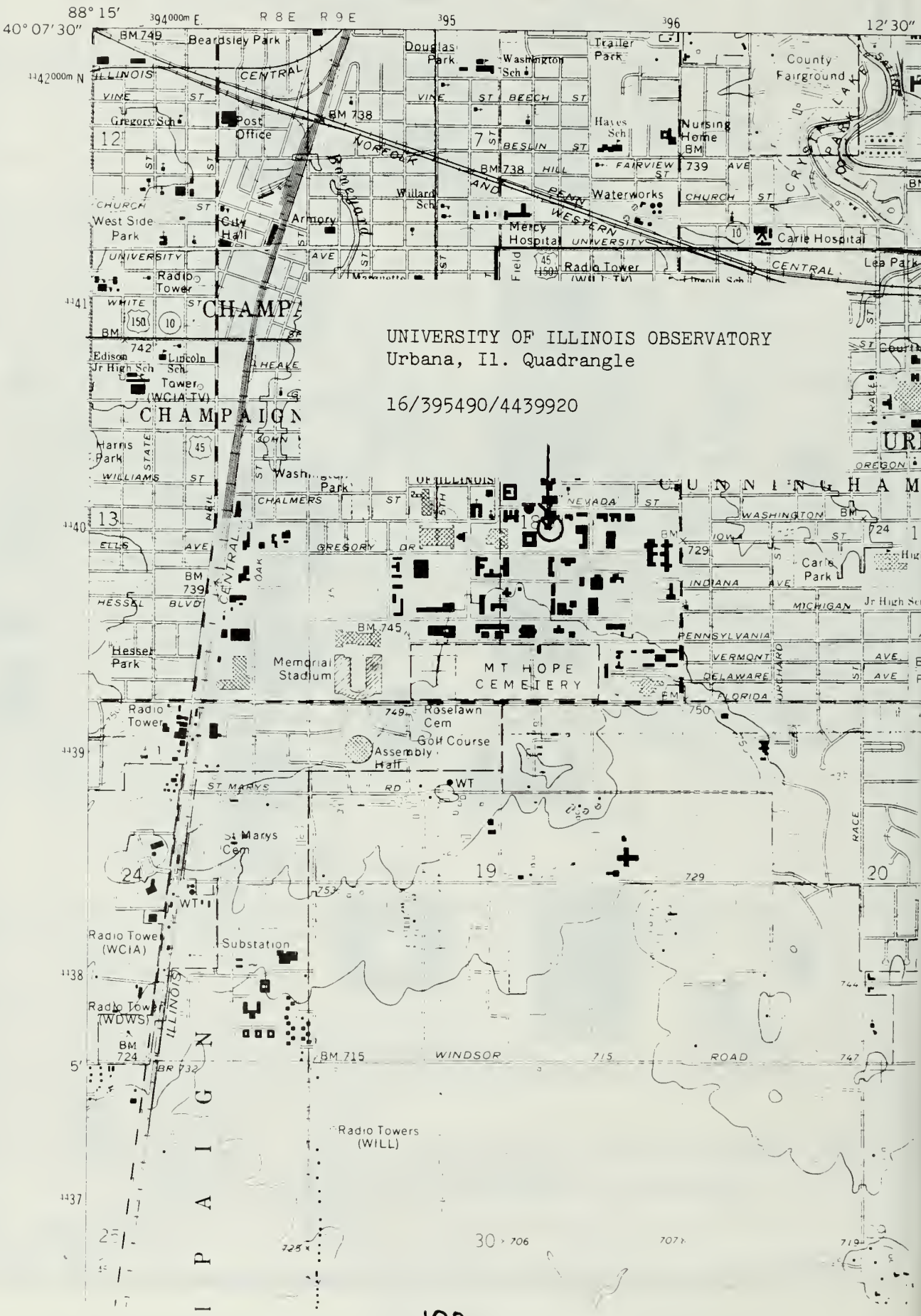
ILLUSTRATION OF BUILDING ADDITIONS



PROPERTY IN RELATIONSHIP
TO THE UNIVERSITY QUADRANGLE

3366 III NE
(RISING)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



UNIVERSITY OF ILLINOIS OBSERVATORY
Urbana, Il. Quadrangle

16/395490/4439920



University of Illinois Observatory — Urbana, Illinois
Exterior View of the Observatory from the South, 1987

Photo Credit: Dr. John Dickel



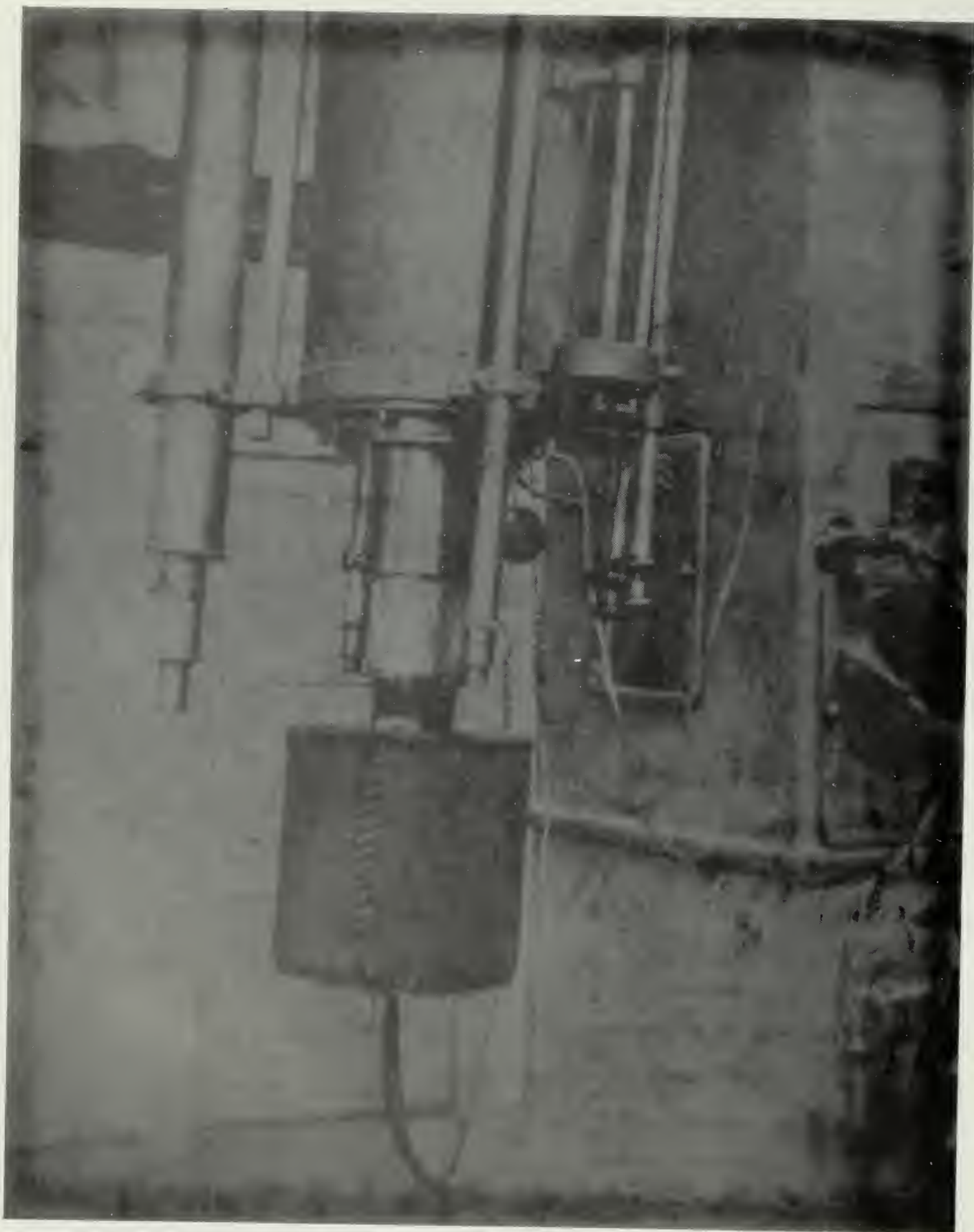
University of Illinois Observatory — Urbana, Illinois
12-inch Refractor, 1987

Photo Credit: Dr. John Dickel



University of Illinois Observatory — Urbana, Illinois
Photoelectric Photometer mounted on the 12-inch Refractor, 1913

Photo Credit: Dr. John Dickel



University of Illinois Observatory — Urbana, Illinois
Selenium cell Photometer on the 12-inch Refractor, 1910

Photo Credit: Dr. John Dickel

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

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1. Name of Property

historic name Gaithersburg Latitude Observatory

other names/site number _____

2. Location

street & number 100 DeSellum Avenue

not for publication

city, town Gaithersburg Latitude Observatory

vicinity

state Maryland

code MD

county Montgomery

code 031

zip code 20877

3. Classification

Ownership of Property

- private
 public-local
 public-State
 public-Federal

Category of Property

- building(s)
 district
 site
 structure
 object

Number of Resources within Property

Contributing	Noncontributing
<u>1</u>	<u>2</u> buildings
<u>1</u>	<u> </u> sites
<u>5</u>	<u> </u> structures
<u>7</u>	<u> </u> objects
<u>7</u>	<u>2</u> Total

Name of related multiple property listing: _____

Number of contributing resources previously listed in the National Register 9

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of certifying official _____

Date _____

State or Federal agency and bureau _____

In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of commenting or other official _____

Date _____

State or Federal agency and bureau _____

5. National Park Service Certification

I, hereby, certify that this property is:

- entered in the National Register.
 See continuation sheet
 determined eligible for the National Register. See continuation sheet.
 determined not eligible for the National Register.
 removed from the National Register.
 other, (explain:) _____

Signature of the Keeper _____

Date of Action _____

6. Function or Use

Historic Functions (enter categories from instructions)

Research Facility

Current Functions (enter categories from instructions)

Research Facility

7. Description

Architectural Classification

(enter categories from instructions)

no style

Materials (enter categories from instructions)

foundation concrete, fieldstone

walls wood

roof wood

other

Describe present and historic physical appearance.

The Gaithersburg Latitude Observatory is situated west of the southern end of DeSillum Avenue and south of James Street on a 2.3 acre tract in the city of Gaithersburg, Maryland.¹

The Gaithersburg Latitude Observatory is a small, 13-foot-square one-story building. There is a wooden louver-covered gable roofed entrance porch on the west facade. The original porch door is missing. There is a small shed-roofed ell on the east side. The building has a concrete mortar and fieldstone foundation. The gable roof consists of two sections that move apart on wheels exposing the center interior of the building. The roof is constructed of inch tongue-and-groove board. In the eaves, the rafter ends are cut back and covered by a tilted fascia board. A decorative wooden five-pointed star is mounted in the center of each gable end.

The inner wall plates consist of double two by eights resting on edge. On the north and south walls, these plates extend about three feet beyond the building to support the roof in its open position. These extended plates are capped with four by fours supporting the metal U-track in which the roof wheels travel. Parallel to the U-track, about six inches into the building and down about four inches, are a pair of one-inch-thick iron rods. These rods extend the length of the north and south plates, piercing the east and west walls. They are moved from inside the building. Each section can be moved independently by a rope and pulley system. There are two decorated ventilators, one on each roof section near the center of the building. As a part of the decoration, a metal five-pointed star caps each ventilator.

The building is double walled. The inner wall consists of four by fours overlaid with tongue and groove boards on the inside. There is a nine-inch space between the walls. The outer wall consists of four by fours covered on the outside with horizontal framed wooden louvers. The outside walls are connected to the inner walls only at the building corners, the entrance and the door to the east ell. The inner and outer sills appear to rest on the foundation. The exterior wall ends at the ground in a bevelled wooden water table. There is a double floor in the main room with a concrete pyramid-shaped pier in the center

 See continuation sheet

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Section number 7 Page 2

of the dirt floor that is sunk four feet below the floor and tapers as it extends up to about waist height. The observing telescope and instruments were mounted on it. The telescope is now in storage in Corbin, Virginia. The southern wall has a central section of two by three feet which can be lowered to expose two sliding wooden sashes in the inner wall.

About 200 feet to the south of the observatory is the Meridian Mark Pier (azimuth marker), a green metal pagoda-shaped object about four feet high by two feet square, which was used to align the Zenith Telescope.

Five Coast and Geodetic Survey monuments are located on the property of the observatory. These monuments establish exact geographic longitude and latitude positions, elevation above sea level, and the direction of the magnetic north field of force. The Observatory RM-1 monument, dated 1966 is still used by the National Oceanographic and Atmospheric Administration (NOAA), for positional testing of new technology in the Global Positioning System (GPS) Receiver which tracks orbital satellites. A 1-1/2 story brick caretaker's house and garage, constructed in 1947, is seventy-feet to the south of the observatory building.

Only the observatory building, the Meridian Mark Pier, and the five monuments described above are considered to contribute to the significance of the Gaithersburg Latitude Observatory as a National Historic Landmark. The caretaker's house and garage do not contribute to the significance of the site and are excluded from this nomination.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

nationally statewide locally

Applicable National Register Criteria A B C D NHL Criteria 1

Criteria Considerations (Exceptions) A B C D E F G

Area of Significance (enter categories from instructions)

Period of Significance

Significant Dates

National Register Significance:

1899-1982

1899-1982

Science

National Historic Landmark Significance:

Science, Subtheme: Physical Science,

Facet: Astronomy, Earth Science

Cultural Affiliation

Significant Person

Architect/Builder

Edwin Smith

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

Summary

The Gaithersburg Latitude Observatory is significant for its association with the study of polar motion, and for its symbolic value in representing an important and long-lived program of international scientific cooperation. Established in 1899 by the International Geodetic Association, the International Polar Motion Service was a cooperative effort among scientists worldwide to study the Earth's wobble on its rotational axis. The Gaithersburg Latitude Observatory was one of six observatories around the world (in the United States, Russia, Japan, and Italy) commissioned under this program.

Between 1900 and 1960 these observatories were the best source of information on polar motion available to scientists. Data supplied by the six latitude observatories have been used in hundreds of scientific papers and studies investigating the geophysics of the earth. The observatories have enabled geodesists to better understand the size and shape of the earth and astronomers to adjust their observations for the effects of polar motion. In more practical terms, the work done by the observatories contributed to studies attempting to determine earthquake mechanisms and the elasticity of the earth, and to predict climate variations. The space program has also benefited from this work; polar motion study is necessary to determine orbit patterns of spacecraft and satellites, and aids tracking techniques used in deep space navigation.

The latitude observatories made a major contribution to science on an international scale. The research undertaken in these small, simple structures not only fueled all work done in earth motion for decades, but transcended the differences of man during times of war and international strain. Despite the location of stations in two Allied nations and two Axis nations during World War II, cooperation between the observatories continued and their important work did not cease. From its construction in 1899 until the obsolescence of man-operated telescopic observation forced its closing in 1982, the Gaithersburg Latitude Observatory played an integral role in this important scientific endeavor.

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History

The United States Coast and Geodetic Survey Superintendent's Report for 1898-99 records an agreement reached by members of the International Geodetic Association to establish six observatories for the purpose of measuring the variations in latitude caused by the earth's wobble on its polar axis. This program, known as the International Polar Motion Service, was initiated in 1899 with the establishment of six stations, all located near the parallel of 39 degrees 08 minutes north latitude (to permit uniform computations), and were at Gaithersburg, Maryland; Cincinnati, Ohio; Ukiah, California; Mizusawa, Japan; Charjui in Russian Turkestan; and Carloforte, Sardinia, Italy. Economic constraints forced the closing of the Cincinnati observatory in 1932. The Charjui station was lost in World War I, and an observatory was substituted for it at Kitab, near Samarkand in the Soviet Union.

The Gaithersburg Observatory was constructed by Edwin Smith, Chief of the Instrument Division of the U.S. Coast and Geodetic Survey (This agency, now the National Oceanic and Atmospheric Administration, operated the International Polar Motion Service observatories in the United States.) Between 1891 and 1892 Smith had been conducting measurements of the variation of latitude on a volunteer basis from his home in Rockville, Maryland, and made nearly 1800 individual measurements on 146 nights, until his regular work forced him to discontinue his observations. However, when the International Geodetic Association allocated funds for the purchase of land in Gaithersburg in 1898, Smith was entrusted with the construction of the Gaithersburg Observatory, which began operating on October 18, 1899.

The original six observatories around the world worked in close concert carrying out a program of star study selected by Dr. Kimura, the astronomer in charge of the Mizusawa station. Twelve groups of stars, each containing six pairs of stars, were selected. Two groups of stars were observed each night at each station in accordance with a schedule of dates, time, and duration prepared by Dr. Kimura. The irregular daily motion of the earth's axis was believed to be extremely small, but the extent could be determined by the precise measurements of the stars. The six stations worked documenting the data to support latitude variations until 1914. Economic constraints forced the closing of the Gaithersburg and Cincinnati stations in 1915. During World War I contact was lost with the Charjui station. When communication with the Russian observers was resumed, the association learned that star movement data had been recorded through 1919. After World War I the Soviets continued to participate in this program with the establishment of a new station in Kitab in Uzbekistan, USSR.

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While the Cincinnati station remained closed and was eventually dismantled, the Gaithersburg Latitude Observatory resumed operations in 1932. Upon reopening, it functioned continually in cooperation with its sister observatories throughout the world until computerization rendered its use obsolete in 1982.

The scientific work conducted at the Gaithersburg Latitude Observatory illustrates the systematic approach sought by the International Geodetic Association to measure the degree of "wobble" occurring on the earth's north-south axis. Although superseded by newer technologies using satellite observations the wealth of data returned from Gaithersburg and the other five observatories is used by scientists today to determine polar motion; the size, shape and physical properties of the earth; to predict climate and earthquakes; and to aid the space program through the precise navigational patterns of orbiting satellites.

The city of Gaithersburg designated the observatory as a local historic site in December 1983. In July 1985 the site was listed in the National Register of Historic Places. The observatory property was conveyed to the city of Gaithersburg in May 1987 by the federal government, with the proviso that it be preserved as a historic monument and used for the benefit of the public. At the present time the city of Gaithersburg plans to restore the latitude observatory and build a science education center, on the site of the caretaker's house, for the use of the school children of Gaithersburg.

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Continuation Sheet**

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Footnotes

1. Most of the material in this form was adapted from the following source.

Kathleen C. Bowers and James Sengstack, "National Register of Historic Places Inventory-Nomination Form--Gaithersburg Latitude Observatory" (Gaithersburg, Maryland: City Planning Department, 1984).

National Register of Historic Places Continuation Sheet

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Bibliography

Bowers, Kathleen C. and James Sengstack. "National Register of Historic Places Inventory-Nomination Form--Gaithersburg Latitude Observatory." Gaithersburg, Maryland: City Planning Department, 1984.

Hosayama, Kennosuke. "Reorganization Plan of the International Latitude Observatory of Mizusawa," Publications of the International Latitude Observatory of Mizusawa, 1987, pp. 1-26.

Lambert, W. D. "Who Shot Those Peas," Geodetic Letter, September 1936, pp. 1-9.

Smith, Edwin and F. Schlesinger. The International Latitude Service at Gaithersburg, Md., and Ukiah, Cal., under the Auspices of the International Geodetic Association, No Place of Publication, Coast and Geodetic Survey. Appendix No. 5, 1900.

Townley, Sidney D. "Variation of Latitude," Publications of the Astronomical Society of the Pacific, August 10, 1907, pp. 210-212.

Wilcove, Raymond. "Why Mother Earth Wobbles," Environmental Science and Services Administration World, October 1967, pp. 10-11.

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Continuation Sheet

Section number 10 Page 2

VERBAL BOUNDARY DESCRIPTION:

Beginning at a stone planted in the ground at intersection of lands of Ignatius Fulks, Vandelia Owen, and Philomen M. Smith whose coordinates on the Maryland State Plane Coordinate System are X=743,442.70 feet, Y=474,772.03 feet, and running thence S 46°30' W 300 feet; thence S 43°30' E 270 feet; thence N 46°30' W 444.6 feet; thence N 71°40' W 53.5 feet to a stone whose coordinates are X=743,691.26 feet, Y=474,722.99 feet; thence still N 71°40' W 252.8 feet to the place of beginning containing 2.307 acres of land more or less.

9. Major Bibliographical References

See Continuation Sheet

See continuation sheet

Previous documentation on file (NPS):

- preliminary determination of individual listing (36 CFR 67) has been requested
- previously listed in the National Register
- previously determined eligible by the National Register
- designated a National Historic Landmark
- recorded by Historic American Buildings Survey # _____
- recorded by Historic American Engineering Record # _____

Primary location of additional data:

- State historic preservation office
- Other State agency
- Federal agency
- Local government
- University
- Other

Specify repository: _____

10. Geographical Data

Acreage of property 2.3 acres

UTM References

A 18 309930 4334030
 Zone Easting Northing

C _____

B _____
 Zone Easting Northing

D _____

See continuation sheet

Verbal Boundary Description

See Continuation Sheet

See continuation sheet

Boundary Justification

The nominated property, 2.3 acres, comprises the acreage historically associated with with the resource. The property is surrounded on the north, south, and west by modern residential development, and the grounds of a recently constructed public high school abuts it on the south.

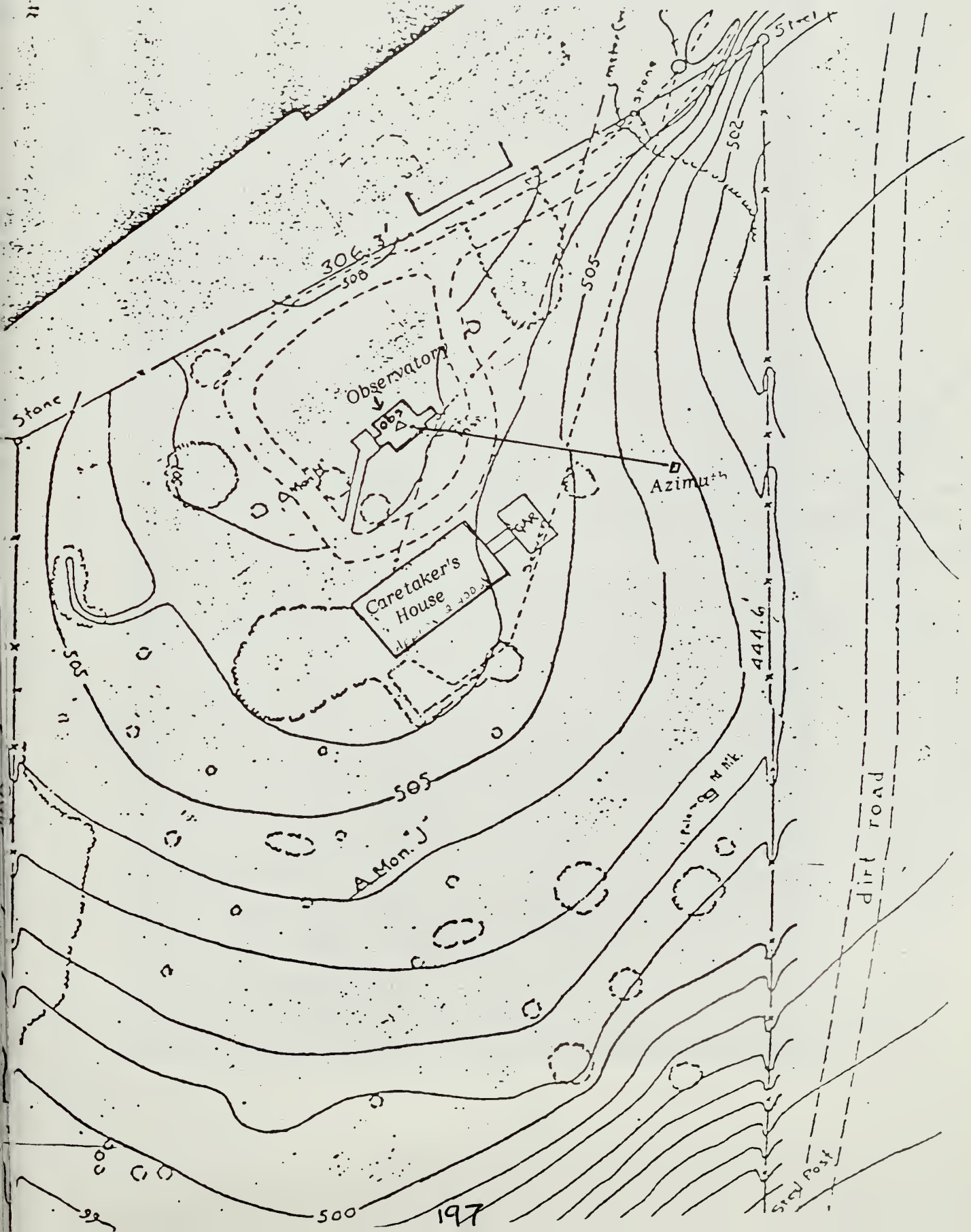
See continuation sheet

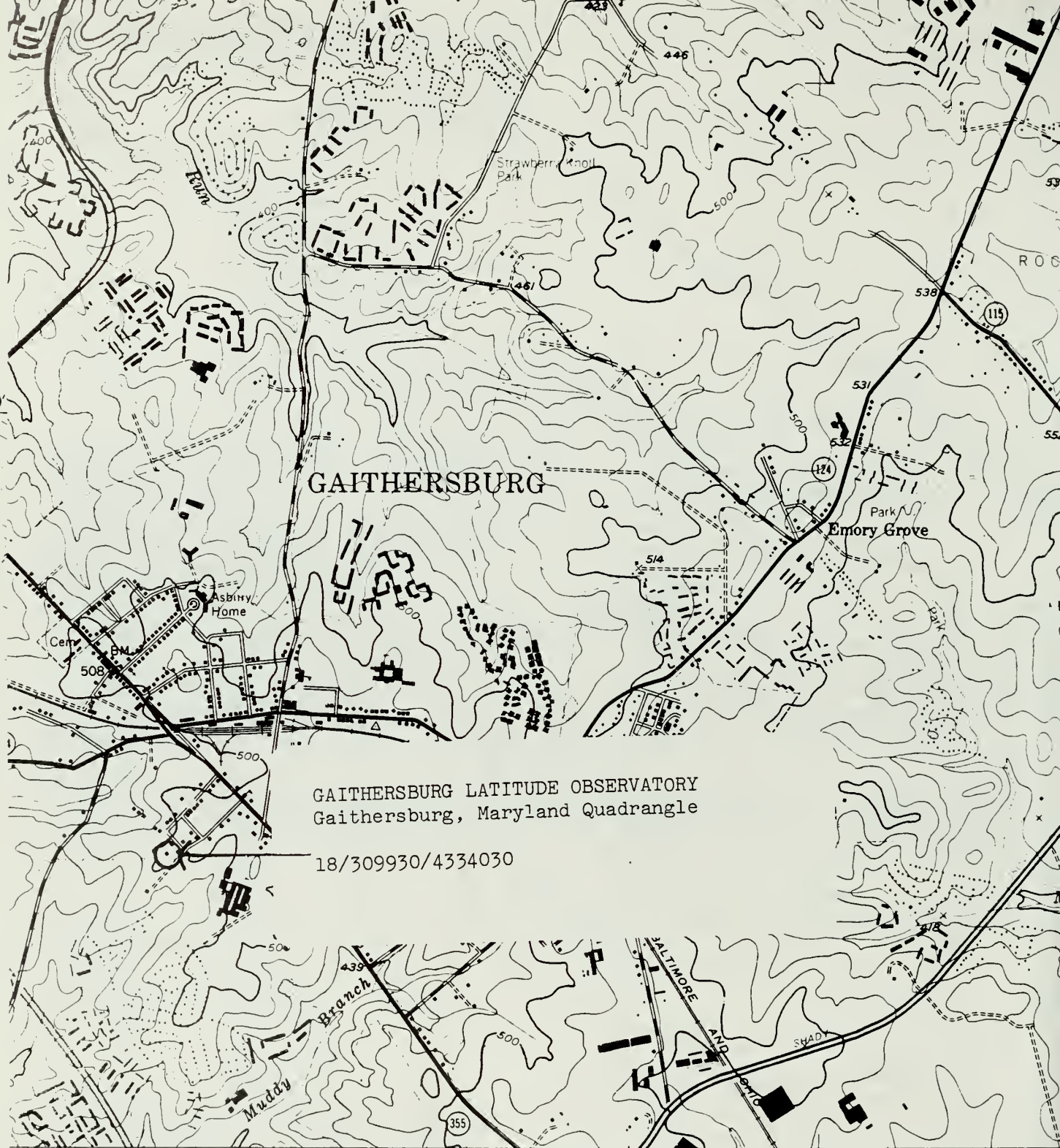
11. Form Prepared By

name/title Harry Butowsky date May 1, 1989
 organization National Park Service telephone (202) 343-8155
 street & number 1100 L Street, N.W. city or town Washington state DC zip code 20013

2.3 acres

Topo showing location of caretaker's house in relation to Observatory and Azimuth
100 DeSillum Avenue
Gaithersburg, Maryland
Montgomery County





GAITHERSBURG LATITUDE OBSERVATORY
Gaithersburg, Maryland Quadrangle

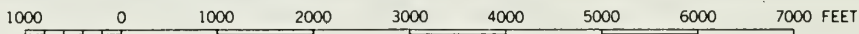
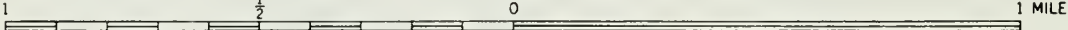
18/309930/4334030

ROCKVILLE 3.5 MI
ON D. C. (WHITE HOUSE) 20 MI

(ROCKVILLE)
5562 11 SW

DERWOOD 1.2 MI.
ROCKVILLE 3.5 MI

SCALE 1:24000



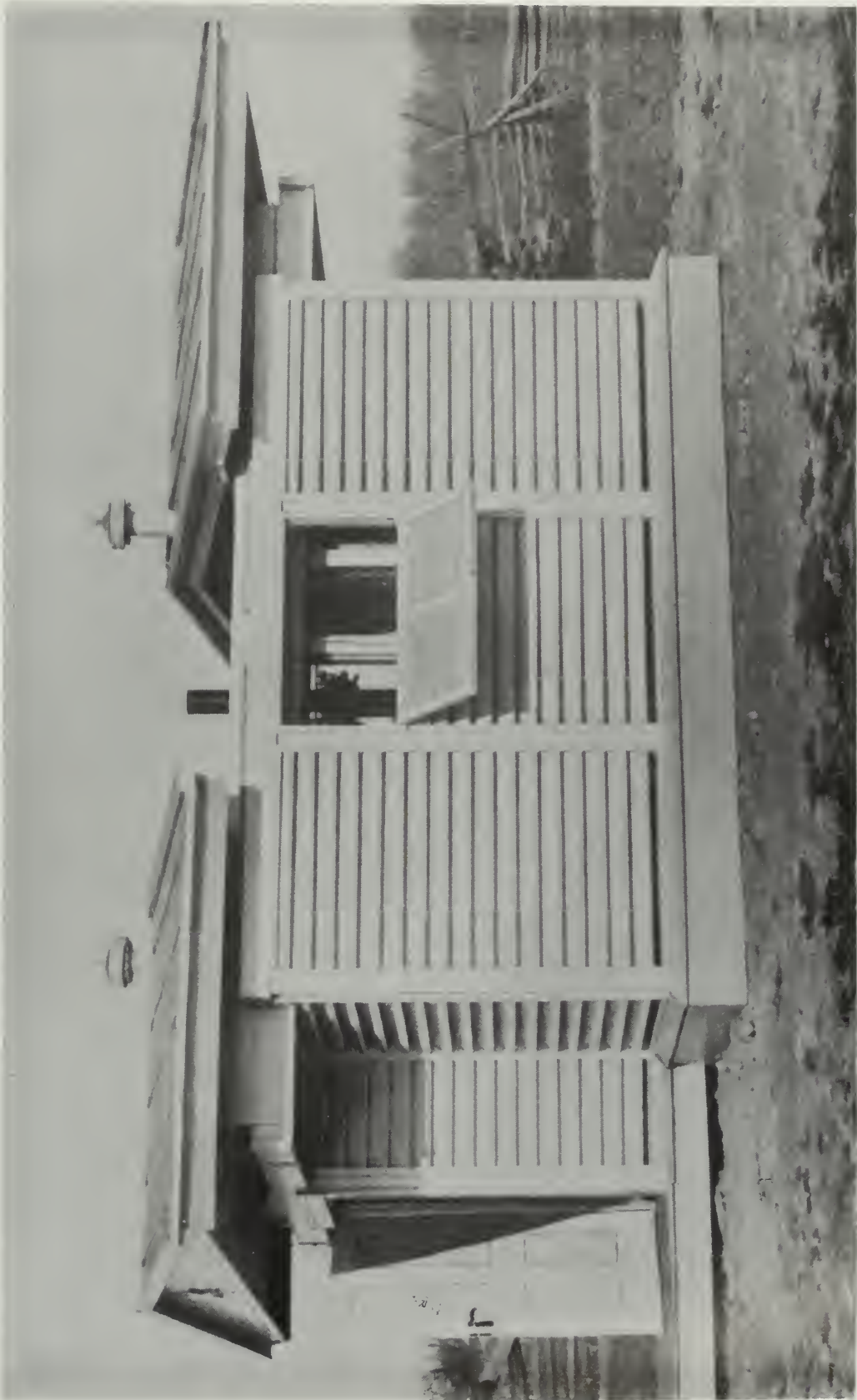
CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

Revisions shown in purple and ...
Survey from aerial photographs taken ...
This information not to be used for ...
Boundary lines shown in purple ...
information available from the ...
Purple tint indicates ...



QUADRANGLE LOCATION



Gaithersburg Latitude Observatory — Gaithersburg, Maryland
Exterior View from the South, circa 1910

Photo Credit: City of Gaithersburg



Gaithersburg Latitude Observatory — Gaithersburg, Maryland
Interior of the observatory with telescope and observer.

Photo Credit: City of Gaithersburg



Gaithersburg Latitude Observatory — Gaithersburg, Maryland
Exterior View from the West, 1983

Photo Credit: City of Gaithersburg



Gaithersburg Latitude Observatory — Gaithersburg, Maryland
Exterior View from the East, 1983

Photo Credit: City of Gaithersburg



Gaithersburg Latitude Observatory — Gaithersburg, Maryland
Meridian Marker, circa 1983

Photo Credit: City of Gaithersburg



Gaithersburg Latitude Observatory — Gaithersburg, Maryland
USGS Marker



Gaithersburg Latitude Observatory — Gaithersburg, Maryland
USGS Marker



Gaithersburg Latitude Observatory — Gaithersburg, Maryland
USGS Marker



Gaithersburg Latitude Observatory — Gaithersburg, Maryland
USGS Marker



Gaithersburg Latitude Observatory — Gaithersburg, Maryland
USGS Marker

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name Blue Hill Meteorological Observatory

other names/site number _____

2. Location

street & number Blue Hills Reservation

not for publication

city, town Milton

vicinity

state Massachusetts code MA

county Norfolk

code 021

zip code 02186

3. Classification

Ownership of Property

- private
- public-local
- public-State
- public-Federal

Category of Property

- building(s)
- district
- site
- structure
- object

Number of Resources within Property

Contributing	Noncontributing
<u>1</u>	_____
_____	_____
_____	_____
_____	_____
<u>1</u>	_____
	Total

Name of related multiple property listing: _____

Number of contributing resources previously listed in the National Register 1

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of certifying official _____

Date _____

State or Federal agency and bureau _____

In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of commenting or other official _____

Date _____

State or Federal agency and bureau _____

5. National Park Service Certification

I, hereby, certify that this property is:

- entered in the National Register.
 See continuation sheet.
- determined eligible for the National Register. See continuation sheet.
- determined not eligible for the National Register.
- removed from the National Register.
- other, (explain): _____

Signature of the Keeper _____

Date of Action _____

6. Function or Use

Historic Functions (enter categories from instructions)

Research Facility

Current Functions (enter categories from instructions)

Research Facility

7. Description

Architectural Classification

(enter categories from instructions)

Late Gothic Revival

Materials (enter categories from instructions)

foundation concrete

walls concrete, stone

roof copper

other

Describe present and historic physical appearance.

The Blue Hill Meteorological Observatory was founded by Abbott Lawrence Rotch on February 1, 1885, as a weather station and research facility. Rotch located the observatory atop the Great Blue Hill in the Blue Hills Reservation, a 6,000-acre public park managed by the Metropolitan District Commission of the Commonwealth of Massachusetts in Milton, Massachusetts. Rotch chose the site because the elevation of 635 feet was the highest point within ten miles of the Atlantic Ocean, anywhere on the East Coast south of central Maine. This location afforded early weather scientists a unique opportunity for recording extremes of weather and experimenting with weather-recording instruments.

Construction of the observatory was started by Rotch in 1884 using his own private funds. The original structure consisted of a two-story circular tower and an adjoining housing unit which contained two bedrooms, a dining room and a kitchen. In 1889 a two-story east wing was added to provide additional working space for research, domestic chores, and the library. In 1902 a two-story west wing containing a new library was added to provide additional work space. A steel fire door and brick wall connect the library to the earlier masonry structure. A timbered vault (18 by 35 feet) of cohesive tiles spans the library. The timbered vault tile roof is believed to have been installed by the Guastivino Company using an extremely tenacious mortar developed by Raphael Guastivino, the founder of the firm. Native stone, gathered from the summit of the Great Blue Hill, was used for the two-story tower, adjoining housing unit, and the east and west wings. Copper sheathing was used for roofing.¹ A stone wall and iron fence were erected in 1905 to provide security for the building and instruments and privacy for the staff.

The original stone tower eventually proved to be unsuitable. Wind-driven rain penetrated its walls, damaging the instruments and records. Vibration from the instruments on masts atop the tower contributed to the structural problems.

In 1908 the original tower was demolished and a new reinforced three-story late Gothic Revival concrete tower, 20 feet 6 inches wide and 32 feet 8 inches high was constructed in its place. The concrete construction of the tower was chosen specifically to provide the maximum amount of stability and durability

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in the event of high winds. The tower has a crenelated top and a cornice containing dentils. The windows are double-hung sash with a shallow recessed arch over the windows on the first and second floors.

The new tower provided the durable weather-resistant, vibration-free environment necessary for accurate instrument readings. The first floor of the tower contains the director's office. The weather bureau is on the second floor and a laboratory and access to the roof are found on the third floor. Various wind gauges and other meteorological recording instruments are attached to the roof of the tower. The observatory still retains barometers and other instrumentation dating from the late 19th century. These instruments are used to calibrate the modern instrumentation to preserve the accuracy and integrity of the data base dating back to 1885.

In 1962 a metal tower containing a siderostat for collecting the sun's rays and directing them by mirrors to an optical bench inside the observatory, was erected adjacent to the west wing for studies related to the upper atmosphere. This project was abandoned after a few years; this tower, with its mirrors still present, is no longer in use.

The observatory has been neglected for a number of years. Although the structure is generally weather-tight, due to both solid construction and a copper roof, the reinforced concrete tower is plagued by the elements. The frost-thaw cycle has caused some cracking and spalling of the concrete.

In 1981 the Metropolitan District Commission transferred responsibility for the observatory to the Blue Hill Weather Club, a local group of supporters, who plan to restore the observatory and establish a weather museum on the site. The observatory will be kept open to continue its record of continuous weather observations. The National Weather Service continues to operate an automated weather station in the building.

In 1980 the building was listed in the National Register of Historic Places as part of the "Prehistoric and Historic Resources of the Blue Hills and Neponset River Reservations and Selected Adjacent Lands" nomination by the Commonwealth of Massachusetts.

A white marble stone containing a summary record of climatological data from 1885 to 1984 and dedicated to the memory of Abbott Lawrence Rotch is located on the front yard of the building.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

nationally statewide locally

Applicable National Register Criteria A B C D NHL Criteria 1,2

Criteria Considerations (Exceptions) A B C D E F G

Areas of Significance (enter categories from instructions)

Period of Significance

Significant Dates

National Register Significance:
Science

1885-Present

National Historic Landmark: Science,
Subtheme: Earth, Science, Facet:
Meteorology

Cultural Affiliation
N/A

Significant Person

Abbott Lawrence Rotch

Architect/Builder

Arthur Rotch, George T. Tilden

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

Summary

The Blue Hill Meteorological Observatory is the foremost structure associated with the history of weather observations in the United States. Founded by Abbott Lawrence Rotch on February 1, 1885, the observatory took a leading role in the newly emerging science of meteorology and was the scene of many of the first scientific measurements of upper atmosphere weather conditions, using kites to carry weather instruments aloft. Knowledge of wind velocities, air temperature and relative humidity at various levels came into use as vital elements in weather prediction due to techniques developed at this site. By 1895 the observatory was the source of weather forecasts of remarkable accuracy. The observatory remains active to this day, continuing to add to its data base of weather observations now more than one hundred years old, and stands as a monument to the science of meteorology in the United States.²

History

The Blue Hill Meteorological Observatory was founded by American meteorologist Abbott Lawrence Rotch (1861-1912) in 1885. As a young man Rotch became interested in the newly developing science of meteorology and determined to make this field his lifetime career. By the time he graduated from the Massachusetts Institute of Technology in 1884 Rotch had conceived and carried into execution his plans for the erection of a meteorological observatory on the summit of the Great Blue Hill, ten miles south of Boston, Massachusetts. His purpose was to establish an institution free from official control where investigations might be independent of prescribed duties and requirements. Since Rotch was independently wealthy he carried out his plan using his own funds. The observatory building was completed by the end of 1884 and the first regular observations were begun on February 1, 1885. Rotch became the first director of the observatory and maintained it at his own expense until his death in 1912 when he bequeathed it to Harvard University with an endowment of \$50,000.³

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Under Rotch's leadership, the Blue Hill Meteorological Observatory quickly became famous for its pioneering studies of the upper atmosphere. In 1885 Rotch was able to obtain basic data on the heights and movements of various clouds by means of triangulation measurements. In 1894 Rotch became the first in the world to sound the atmosphere by lifting instruments on kites. Ultimately kites sounded the atmosphere to an altitude of 5 km. and provided Rotch with information concerning fundamental upper air patterns of wind, temperature and humidity and their relationship to surface weather patterns. In 1904 at the World's Fair in St. Louis, Rotch initiated the use of sounding balloons in America. These balloons carried recording instruments beyond even the highest clouds to a height of 17 km.

The study of cloud heights, directions and velocities that Rotch carried out at the Blue Hill Observatory made significant contributions to the knowledge of clouds in the early years of this century. In addition, Rotch was one of the first to suggest the use of daily maps at local Weather Bureau stations to plot the direction of weather patterns. Rotch and Leon Teisserenc de Bort, discoverer of the stratosphere, made extensive upper air kite measurements from ships in the tropical and sub-tropical North Atlantic. These permitted publication in 1911 of a chart of aerial routes, thus pointing the way to the feasibility of transatlantic air travel aided by air patterns.

Rotch was personally known to the leading meteorologists from Europe because he made it a point to attend all of the meetings of the International Meteorological Committee, and on many occasions was the sole American representative. From 1888 to 1891 and from 1902 to 1906 Rotch served as the first professor of meteorology at Harvard University. During his career, Rotch authored 183 scientific papers and several books on the sciences of meteorology and aeronautics. From 1884 to 1895 he served as the associate editor of the American Meteorological Journal. Rotch continued to work at the Blue Hill Observatory until his death on April 7, 1912. Under the terms of his will the observatory was given to Harvard University with an endowment of \$50,000 for operating costs. Harvard operated the observatory until 1971 when it disassociated itself from the site. The Rotch endowment was kept by Harvard.

After 1912 the Blue Hill Meteorological Observatory continued to operate as an active meteorological observatory. Weather observations and recordings have continued to this day, providing modern meteorologists with a record of uninterrupted climatological observations that is unique in the world. Since these recordings were obtained from the same site, with virtually no environmental change, they provide an important index to atmospheric change. This information is of special importance to students of climatic change, in an age where so many weather records are flawed by environmental and procedural changes, and by repeated moves of the observing site over a number of years. For this

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reason, the National Oceanic and Atmospheric Administration designated the Blue Hill Observatory one of 26 International Benchmark stations within the United States.

Since 1885 the staff of the observatory and others have documented the scientific work completed at the Blue Hill Observatory in almost 900 scientific publications. The observations of the observatory have continued on a daily basis since the day it first opened in 1885, making the observatory one of the oldest continually active weather stations in the United States.

The Blue Hill Meteorological Observatory stands as a monument to Abbott Lawrence Rotch and the development of the science of meteorology and is an important site preserving the oldest continuous record of weather observations in the United States.

United States Department of the Interior
National Park ServiceNational Register of Historic Places
Continuation SheetSection number 8 Page 4Footnotes

1. The descriptive material for this section was taken from the following sources:

Sara B. Chase, "Massachusetts Historical Commission Inventory--Nomination Form--Blue Hill Meteorological Observatory" (Boston, Massachusetts: Society for the Preservation of New England Antiquities, 1979).

William Ralston, Blue Hill Meteorological Observatory (Preliminary Report, No place of publication, no date).

2. Chase, op. cit.
3. Dumas Malone, ed., Dictionary of American Biography (New York: Charles Scribner's Sons, 1943), XVI: pp. 183-184.

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National Park Service

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Bibliography

Chase, Sara B. "Massachusetts Historical Commission Inventory-Nomination Form--Blue Hill Meteorological Observatory." Boston, Massachusetts: Society for the Preservation of New England Antiquities, 1979.

Chase, Sara B., and Stephen A. Cole. "National Register of Historic Places Inventory-Nomination Form--Prehistoric and Historic Resources on the National Register of Historic Places of the Blue Hills and Neponset River Reservations and Selected Adjacent Lands." Boston, Massachusetts: Massachusetts Historical Commission, 1980.

Conover, John H. "The Blue Hill Observatory," Weatherwise, December 1984, pp. 297-303.

_____. "Highlights of the History of the Blue Hill Observatory and the Early Days of the American Meteorological Society," Bulletin of the American Meteorological Society, January 1985, pp. 30-37.

_____. and Alan A. Smith. "Blue Hill 1885-1985," Mount Washington Observatory News Bulletin, Spring 1985, pp. 4-6.

Creedon, Francis P. The Blue Hill Meteorological Observatory Historic Structure Survey Report--Preliminary Report. Unpublished Report, 1982.

Malone, Dumas, ed., Dictionary of American Biography. New York: Charles Scribners Sons, 1943, XVI: pp. 183-84.

No Author. "A Reinforced Concrete Meteorological Observatory," The American Architect, October 7, 1908, pp. 117-118. (Reprinted from Cement Age.)

Ralston, William. Blue Hill Meteorological Observatory--Preliminary Report. No place of publication, no date.

9. Major Bibliographical References

See Continuation Sheet

Previous documentation on file (NPS):

- preliminary determination of Individual listing (36 CFR 67) has been requested
- previously listed in the National Register
- previously determined eligible by the National Register
- designated a National Historic Landmark
- recorded by Historic American Buildings Survey # _____
- recorded by Historic American Engineering Record # _____

See continuation sheet

Primary location of additional data:

- State historic preservation office
- Other State agency
- Federal agency
- Local government
- University
- Other

Specify repository: _____

10. Geographical Data

Acres of property less than 1 acre

UTM References

A

1	9
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3	2	5	4	0	0
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4	6	7	5	2	3	0
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Zone Easting Northing

C

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B

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Zone Easting Northing

D

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See continuation sheet

Verbal Boundary Description

The boundary is the iron and stone wall surrounding the Observatory.

See continuation sheet

Boundary Justification

The boundary includes the entire historic resource nominated in this form.

See continuation sheet

11. Form Prepared By

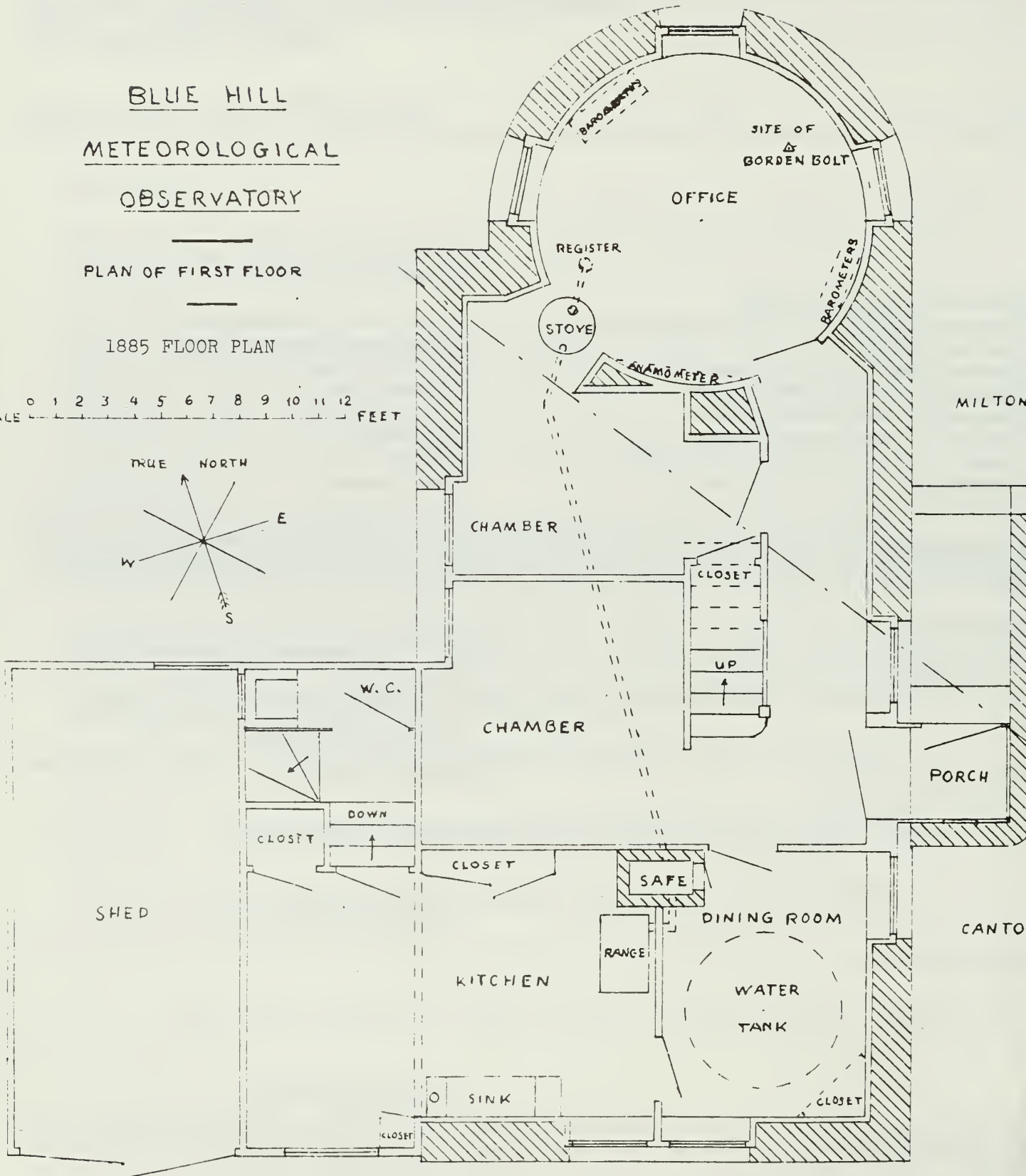
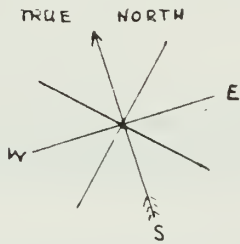
name/title Harry Butowsky date May 1, 1989
organization National Park Service telephone (202) 343-8155
street & number 1100 L Street, N.W. state DC zip code 20013
city or town Washington

BLUE HILL
METEOROLOGICAL
OBSERVATORY

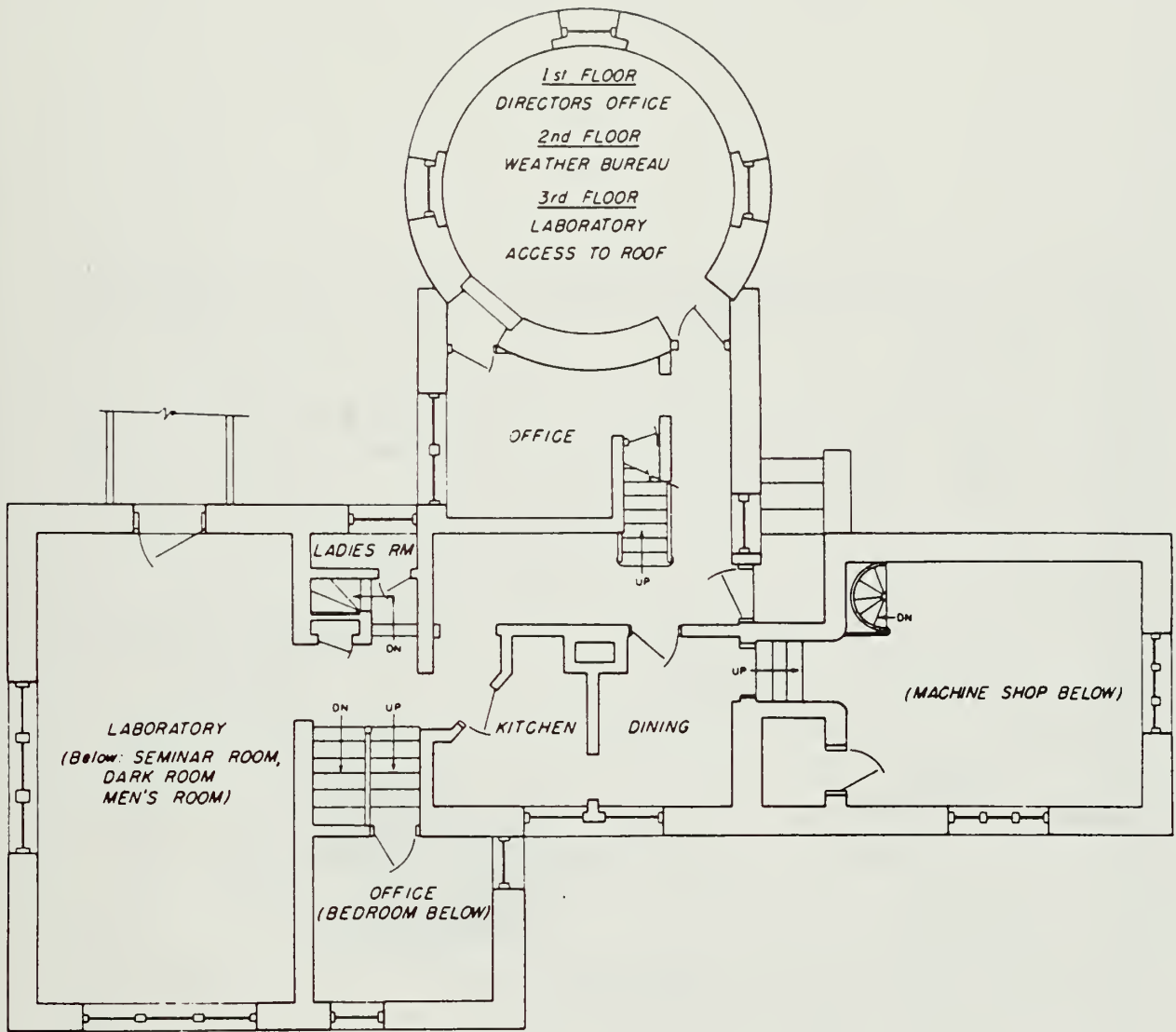
PLAN OF FIRST FLOOR

1885 FLOOR PLAN

0 1 2 3 4 5 6 7 8 9 10 11 12
 SCALE FEET



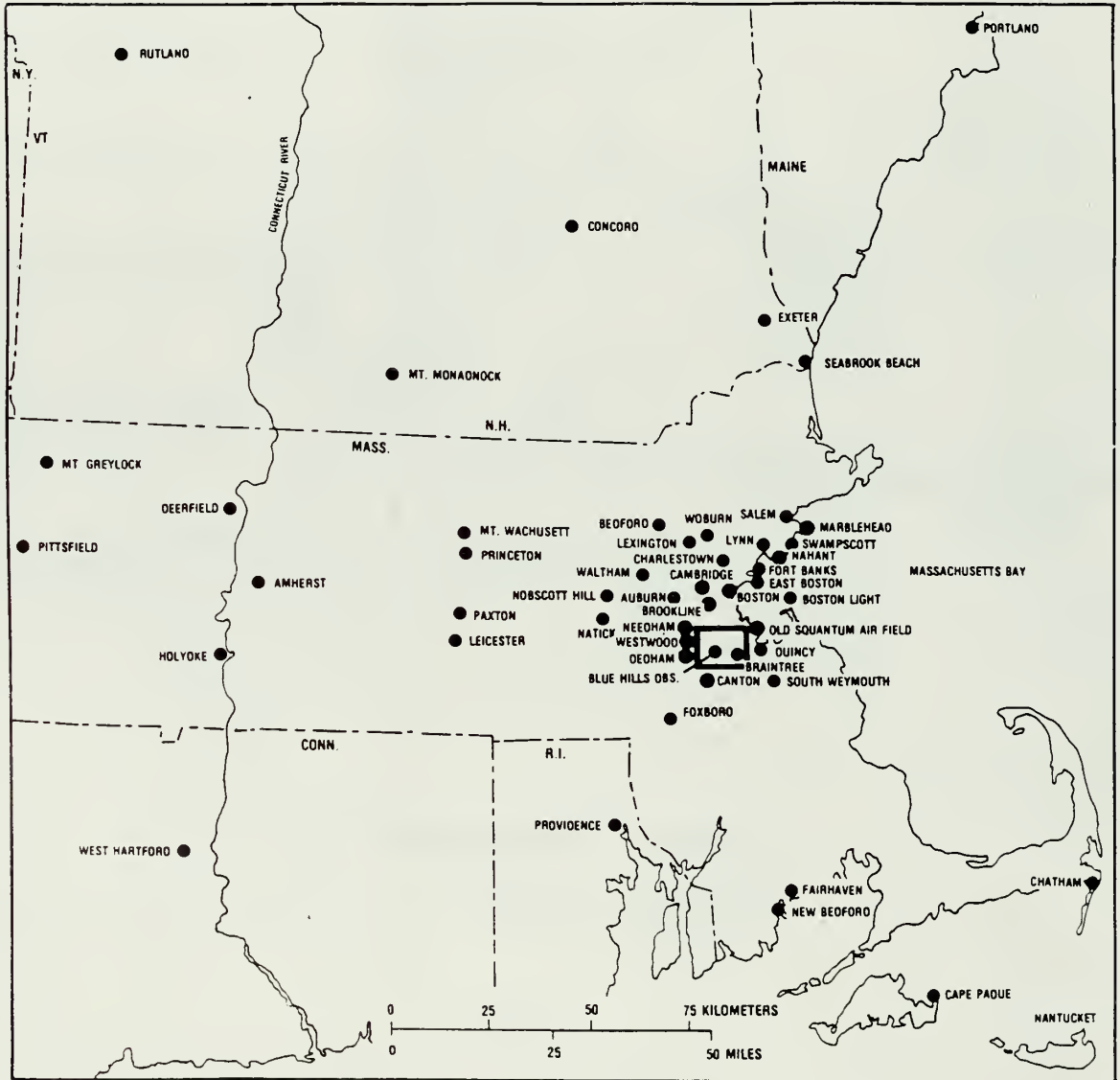
Redrawn from faded photograph on which the building measured $2\frac{3}{16} \times 2\frac{15}{32}$ "
 Scale $\frac{3}{16}'' = 1'0'' \pm$
 Ebenezer Gay
 Harvard Collection of Historical Scientific Instruments
 March 1985



BLUE HILL OBSERVATORY

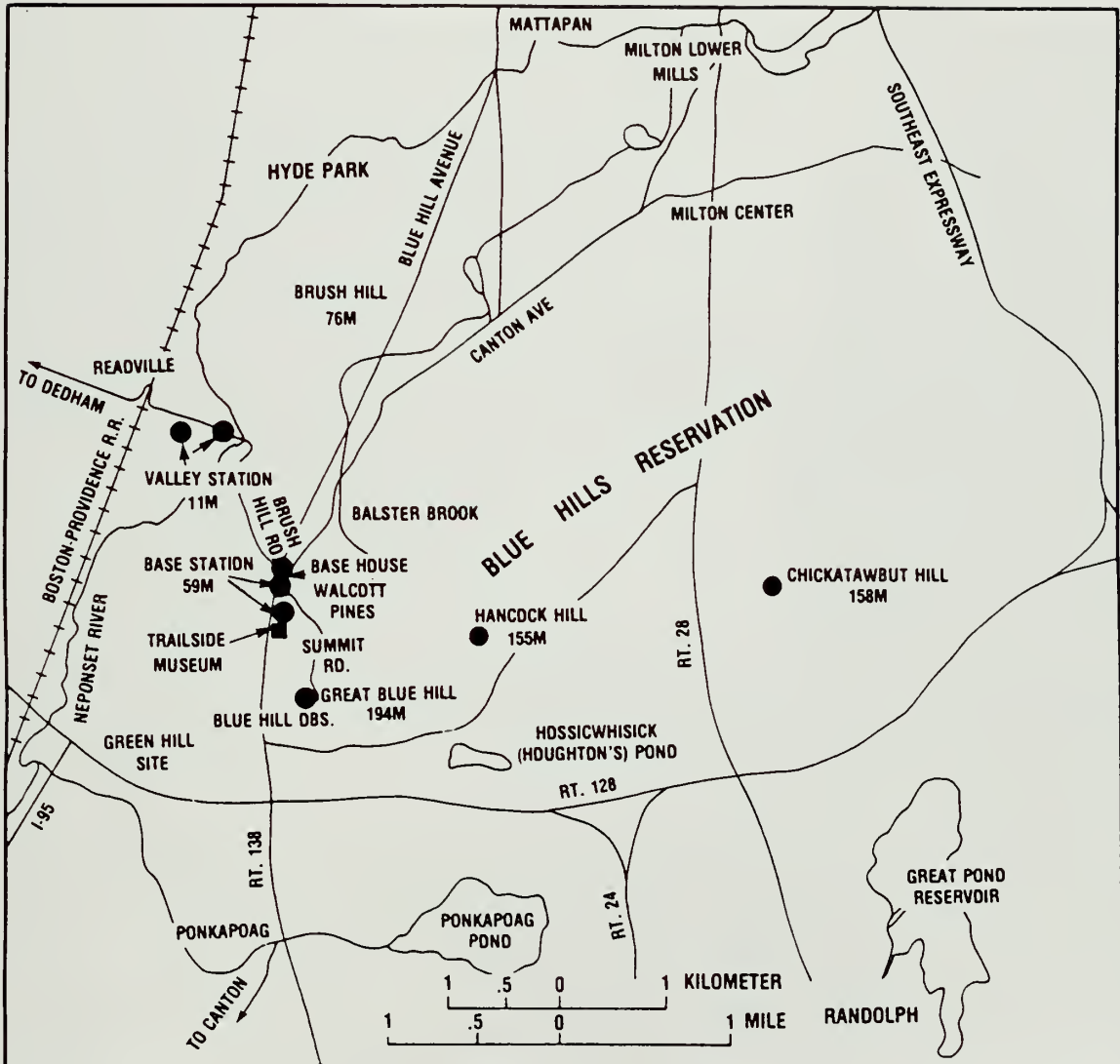
1962 FLOOR PLAN

BLUE HILL METEOROLOGICAL OBSERVATORY
 SITE LOCATION MAP



BLUE HILL METEOROLOGICAL OBSERVATORY

SITE LOCATION MAP



6781 SW
(NEWTON)

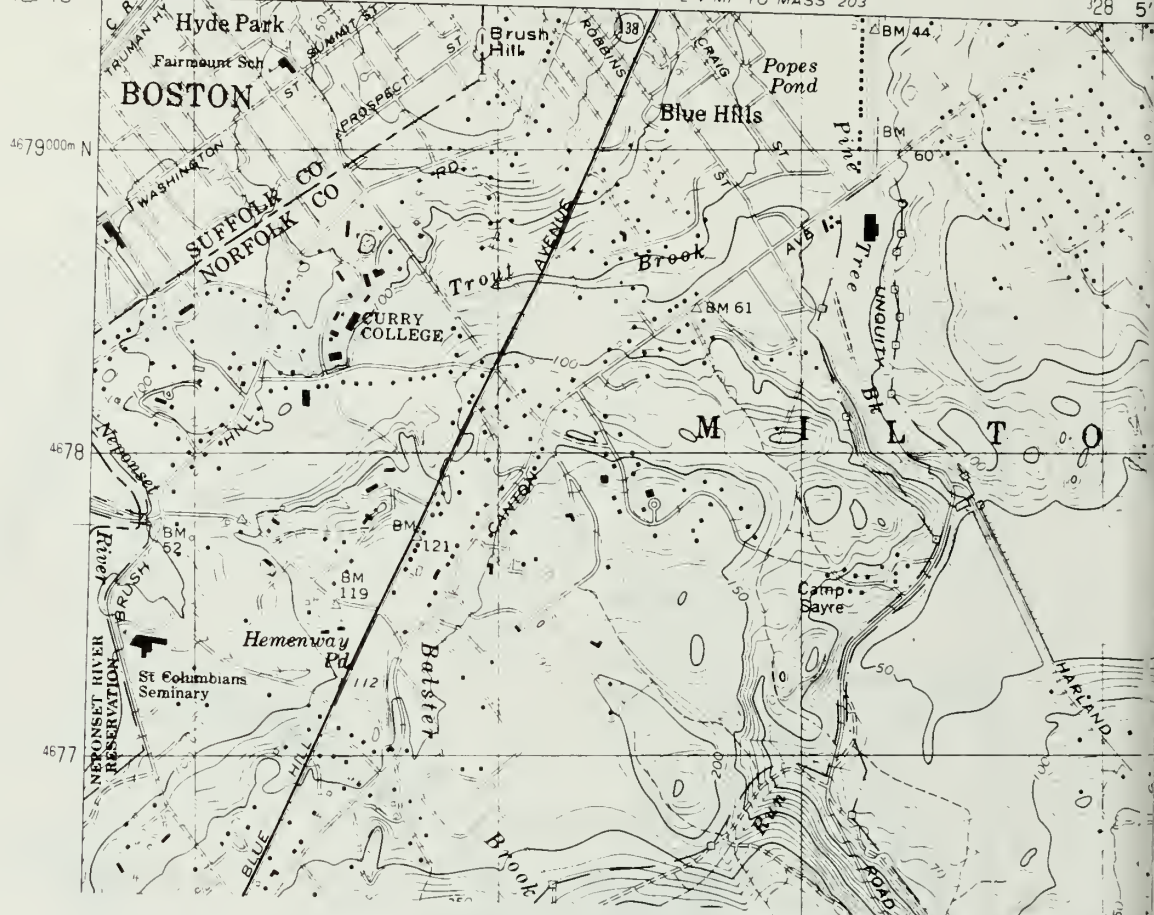
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

71° 07' 30" 325
42° 15'

326000m E

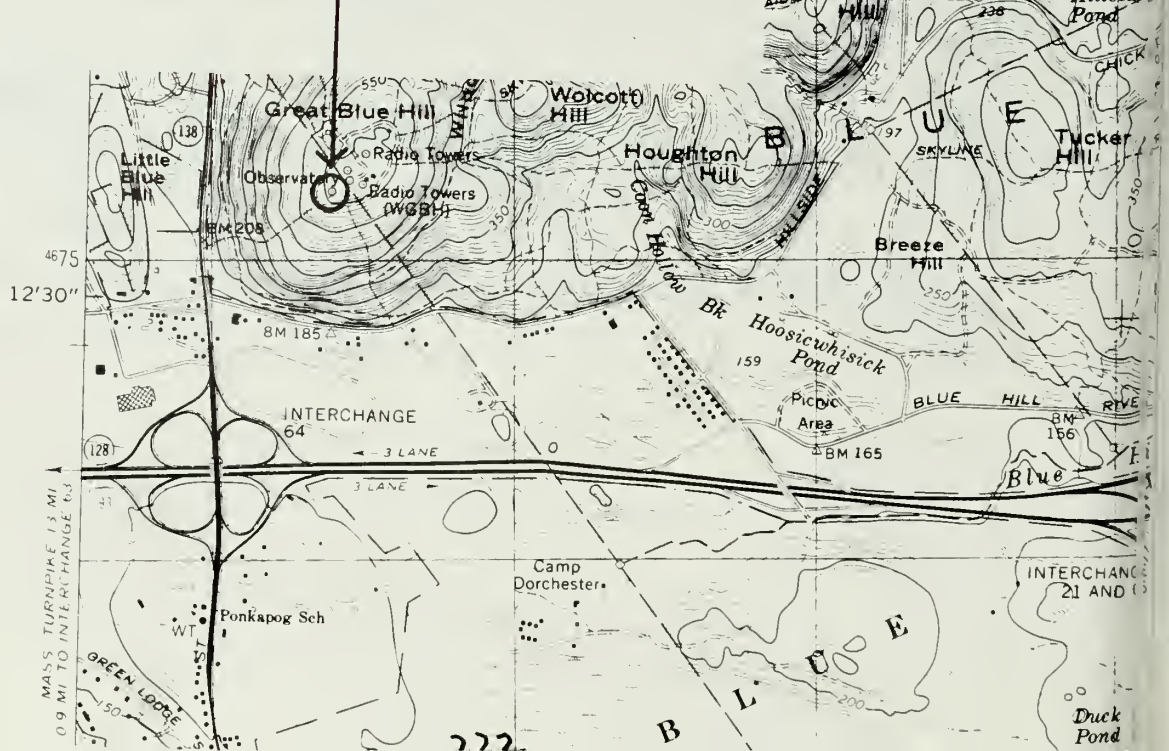
2.4 MI TO MASS 203

BOSTON
26 5'



BLUE HILL METEOROLOGICAL OBSERVATORY
Blue Hills, Mass., Quadrangle

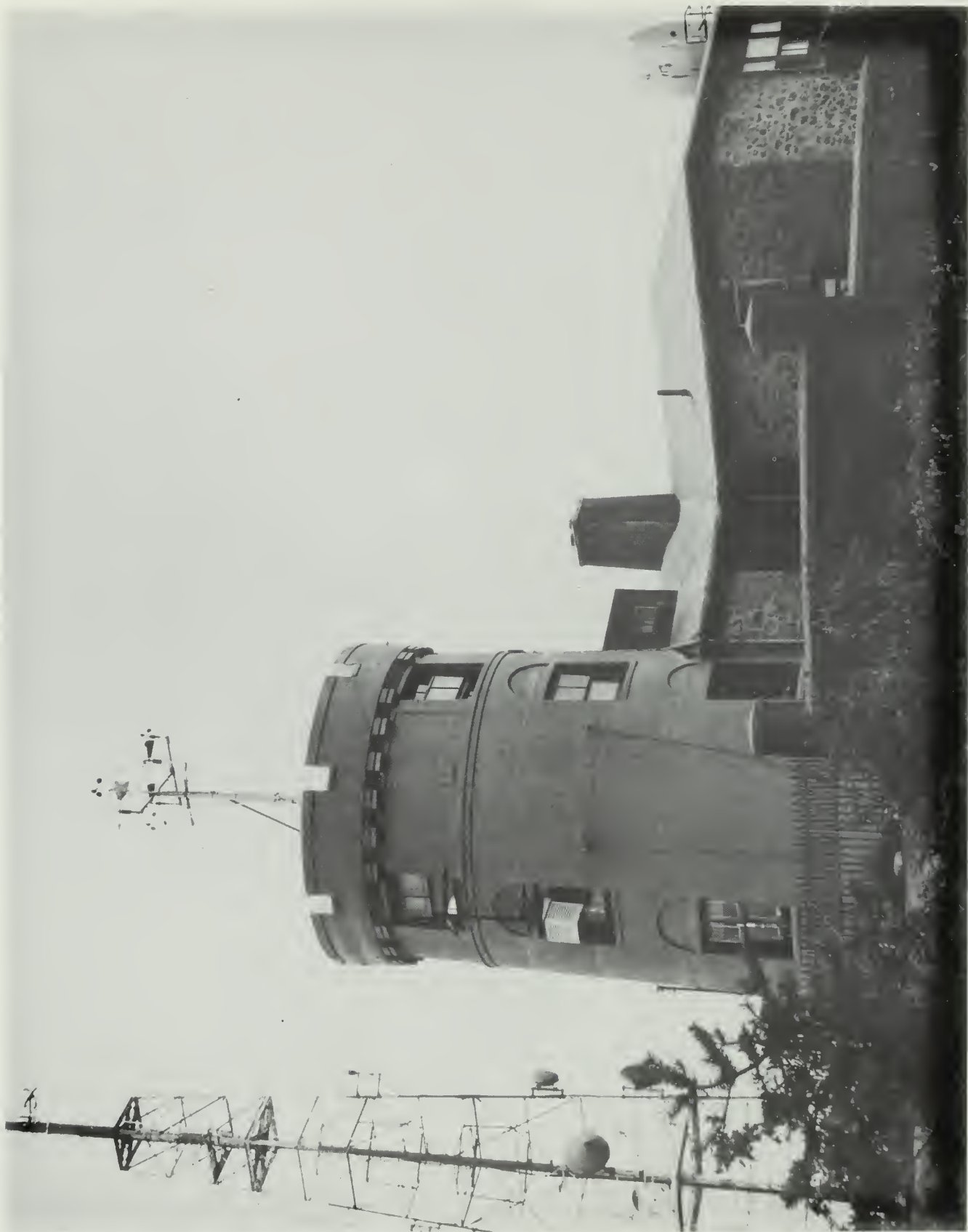
19/325400/4675230





Blue Hill Meteorological Observatory — Milton, Massachusetts
Exterior View from the Southeast, 1895

Photo Credit: John H. Conover



Blue Hill Meteorological Observatory — Milton, Massachusetts
Exterior View from the Southeast, 1984

Photo Credit: John H. Conover

224



Blue Hill Meteorological Observatory — Milton, Massachusetts
Exterior View from the West, 1984

Photo Credit: John H. Conover

CLIMATOLOGICAL DATA
1885 — 1984
BLUE HILL METEOROLOGICAL OBSERVATORY
ELEVATION 635 FT. MSL

TEMPERATURE °F

AVERAGE 47.1

HIGHEST 101 8/10/49, 8/2/75

LOWEST -21 2/9/34

PRECIPITATION IN.

AVERAGE 47.44

24 HR. MAX. 9.93 8/18-19/55 } DIANE

STORM MAX. 12.77 8/18-19/55 }

MONTH MAX. 18.78 8/55

YEAR MAX. 65.51 1972

MONTH MIN. 0.06 3/15

YEAR MIN. 26.96 1965

SNOWFALL

AVERAGE 60.1

24 HR. MAX. 28.2 2/24-25/69

STORM MAX. 38.7 2/24-28/69

MONTH MAX. 65.4 2/69

SEASON MAX. 136.0 1947-48

SEASON MIN. 12.6 1936-37

GREATEST SNOW DEPTH ON THE GROUND IN.

42.0 1/25/48

ATMOSPHERIC PRESSURE MSL

HIGHEST 1052.4 MB (31.08 IN.) 2/13/81

LOWEST 962.8 MB (28.43 IN.) 3/7/32

PERCENT OF POSSIBLE BRIGHT SUNSHINE

AVERAGE 52

MONTHLY MAX. 76 6/71

MONTHLY MIN. 21 4/10

WIND DIRECTION AND SPEED MPH

AVERAGE W 15.4

HIGHEST (5 MIN.) S 121 9/21/38

HIGHEST (CALCULATED GUST) S 186 9/21/38 } HURRICANE

REDEDICATED TO ABBOTT LAWRENCE ROTCH
AND ALL WHO FOLLOWED
ON THE CENTENNIAL OBSERVATION DAY
FEBRUARY 1, 1985

Blue Hill Meteorological Observatory — Milton, Massachusetts
Rotch Memorial Monument, 1985

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name Horn Antenna
other names/site number Horn Reflector Antenna

2. Location

street & number Crawford Hill Facility not for publication
city, town Holmdel vicinity
state New Jersey code NJ county Monmouth code 025 zip code 07733

3. Classification

Ownership of Property	Category of Property	Number of Resources within Property	
<input checked="" type="checkbox"/> private	<input checked="" type="checkbox"/> building(s)	Contributing	Noncontributing
<input type="checkbox"/> public-local	<input type="checkbox"/> district	<u>1</u>	<u> </u> buildings
<input type="checkbox"/> public-State	<input type="checkbox"/> site	<u>1</u>	<u> </u> sites
<input type="checkbox"/> public-Federal	<input checked="" type="checkbox"/> structure	<u> </u>	<u> </u> structures
	<input type="checkbox"/> object	<u>2</u>	<u> </u> objects
			<u> </u> Total

Name of related multiple property listing: _____
Number of contributing resources previously listed in the National Register 0

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of certifying official _____ Date _____
State or Federal agency and bureau _____

In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of commenting or other official _____ Date _____
State or Federal agency and bureau _____

5. National Park Service Certification

I, hereby, certify that this property is:

entered in the National Register.
 See continuation sheet.

determined eligible for the National Register. See continuation sheet.

determined not eligible for the National Register.

removed from the National Register.

other, (explain:) _____

Signature of the Keeper

Date of Action

6. Function or Use

Historic Functions (enter categories from instructions)

Research Facility

Current Functions (enter categories from instructions)

Research Facility

7. Description

Architectural Classification

(enter categories from instructions)

no style

Materials (enter categories from instructions)

foundation concrete

walls N/A

roof N/A

other aluminum, steel

Describe present and historic physical appearance.

The Horn Antenna at Bell Telephone Laboratories in Holmdel, New Jersey, was constructed in 1959 to support Project Echo--the National Aeronautics and Space Administration's passive communications satellite project.¹

The antenna is 50 feet in length with a radiating aperture of 20 x 20 feet and is made of aluminum. The antenna's elevation wheel is 30 feet in diameter and supports the weight of the structure by means of rollers mounted on a base frame. All axial or thrust loads are taken by a large ball bearing at the apex end of the horn. The horn continues through this bearing into the equipment cab. The ability to locate receiver equipment at the apex of the horn, thus eliminating the noise contribution of a connecting line, is an important feature of the antenna. A radiometer for measuring the intensity of radiant energy is found in the equipment cab.

The triangular base frame of the antenna is made from structural steel. It rotates on wheels about a center pintle ball bearing on a track 30 feet in diameter. The track consists of stress-relieved, planed steel plates which are individually adjusted to produce a track flat to about 1/64 inch. The faces of the wheels are cone-shaped to minimize sliding friction. A tangential force of 100 pounds is sufficient to start the antenna in motion.

To permit the antenna beam to be directed to any part of the sky, the antenna is mounted with the axis of the horn horizontal. Rotation about this axis affords tracking in elevation while the entire assembly is rotated about a vertical axis for tracking in the azimuth.

With the exception of the steel base frame, which was made by a local steel company, the antenna was fabricated and assembled by the Holmdel Laboratory shops under the direction of Mr. H. W. Anderson, who also collaborated on the design. Assistance in the design was also given by Messrs. R. O'Regan and S. A. Darby. Construction of the antenna was completed under the direction of Mr. A. B. Crawford from Freehold, New Jersey.

 See continuation sheet

**United States Department of the Interior
National Park Service****National Register of Historic Places
Continuation Sheet**Section number 7 Page 2

When not in use, the antenna azimuth sprocket drive is disengaged, thus permitting the structure to "weathervane" and seek a position of minimum wind resistance. The antenna was designed to withstand winds of 100 miles per hour and the entire structure weighs 18 tons.

The Horn Antenna combines several ideal characteristics: it is extremely broad-band, has calculable aperture efficiency, and the back and sidelobes are so minimal that scarcely any thermal energy is picked up from the ground. Consequently it is an ideal radio telescope for accurate measurements of low levels of weak background radiation.

A plastic clapboarded utility shed 10 x 20 feet, with two windows, a double door and a sheet metal roof, is found next to the Horn Antenna. This structure houses equipment and controls for the Horn Antenna and is included in this nomination.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

nationally statewide locally

Applicable National Register Criteria A B C D NHL Criteria 1, 2.

Criteria Considerations (Exceptions) A B C D E F G

Areas of Significance (enter categories from instructions)

National Register Significance
Science

Period of Significance

1964-1965

Significant Date

National Historic Landmark: Science,
Subtheme: Physical Science, Facet:
Astronomy

Cultural Affiliation

Significant Person

Dr. Arno A. Penzias; Dr. Robert A. Wilson

Architect/Builder

Mr. A. B. Crawford

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

Summary

The Horn Antenna, at the Bell Telephone Laboratories in Holmdel, New Jersey, is significant because of its association with the research work of two radio astronomers, Dr. Arno A. Penzias and Dr. Robert A. Wilson. In 1965 while using the Horn Antenna, Penzias and Wilson stumbled on the microwave background radiation that permeates the universe. Cosmologists quickly realized that Penzias and Wilson had made the most important discovery in modern astronomy since Edwin Hubble demonstrated in the 1920s that the universe was expanding. This discovery provided the evidence that confirmed George Gamow's and Abbe Georges Lemaitre's "Big Bang" theory of the creation of the universe and forever changed the science of cosmology--the study of the history of the universe--from a field for unlimited theoretical speculation into a subject disciplined by direct observation. In 1978 Penzias and Wilson received the Nobel Prize for Physics for their momentous discovery.²

History

"We live in an ocean of whispers left over from our eruptive creation, physicists George Gamow and his colleagues had said. Nobody was listening."³

By the middle of the 20th century cosmologists concerned with the creation of the universe had evolved two leading theories to explain their views. Some astronomers supported the steady-state theory of creation, which stated that the universe has always existed and will continue to survive without noticeable change. Others believed in the "Big Bang" theory of creation which taught that the universe is the glowing debris of a huge fireball that was created in a massive explosion about 16 billion years ago. No one knew for sure which theory was correct.

At Holmdel, New Jersey, in 1964 Dr. Arno Penzias and Dr. Robert Wilson were experimenting with a supersensitive, 20-foot horn-shaped antenna originally built to detect radio waves bounced off Echo balloon satellites. To measure faint radio waves from the Telstar communications satellite, they had to

See continuation sheet

United States Department of the Interior
National Park ServiceNational Register of Historic Places
Continuation SheetSection number 8 Page 2

eliminate all recognizable interference from their receiver. They removed the effects of radar and radio broadcasting, and suppressed interference from the heart in the receiver itself by cooling it with liquid helium to -269°C , only 4° above absolute zero--the temperature at which all motion in atoms and molecules stops.⁴

When Penzias and Wilson reduced their data they found a low, steady, mysterious noise that persisted in their receiver. This residual noise was 100 times more intense than they had expected, was evenly spread over the sky, and was present day and night. They were certain that the radiation they detected on a wavelength of 7.35 centimeters did not come from the Earth, the Sun, or our Galaxy. After thoroughly checking their equipment, the noise remained. Both men concluded that this noise was coming from outside our own galaxy--although they were not aware of any radio source that would account for it.

At that same time, Robert H. Dicke, Jim Peebles, and David Wilkenson, astrophysicists at Princeton University, just 40 miles away, were preparing to search for microwave radiation in this region of the spectrum. Dicke and his colleagues reasoned that the "Big Bang" must have scattered not only the matter that condensed into galaxies but also must have released a tremendous blast of radiation. With the proper instrumentation, this radiation should be detectable.

When a friend told Penzias about a preprint paper he had seen by Jim Peebles on the possibility of finding radiation left over from a fireball that filled the universe at the beginning of its existence, Penzias and Wilson began to realize the significance of their discovery. The characteristics of the radiation detected by Penzias and Wilson fit exactly the radiation predicted by Robert H. Dicke and his colleagues at Princeton University. Penzias called Dicke at Princeton, who immediately sent him a copy of the still-unpublished Peebles paper. Penzias read the paper and called Dicke again and invited him to Bell Labs to look at the Horn Antenna and listen to the background noise. Dicke, Penzias, and Wilson visited the antenna and immediately recognized the significance of their discovery--they had stumbled on to the "embers" of creation predicted by their Princeton colleagues.

To avoid potential conflict, they decided to publish their results jointly. Two notes were rushed to the Astrophysical Journal Letters. In the first, Dicke and his associates outlined the importance of cosmic background radiation as substantiation of the Big Bang Theory. In a second note, jointly signed by Penzias and Wilson titled, "A Measurement of Excess Antenna Temperature at 4080 Megacycles per Second," they noted the existence of the residual background noise and attributed a possible explanation to that given by Dicke in his companion letter.

United States Department of the Interior
National Park Service

**National Register of Historic Places
Continuation Sheet**

Section number 8 Page 3

Harvard physicist Edward Purcell read this announcement and concluded that "It just may be the most important thing anybody has ever seen."⁵

Astronomer Robert Jastrow echoed this conclusion by stating that Penzias and Wilson "...made one of the greatest discoveries in 500 years of modern astronomy."⁶

In 1978, Dr. Arno Penzias and Dr. Robert Wilson were awarded the Nobel Prize for Physics for their joint discovery.

United States Department of the Interior
National Park Service

National Register of Historic Places Continuation Sheet

Section number 8 Page 4

Footnotes

1. The descriptive material for this section was taken from the following sources:

J.S. Hey, The Evolution of Radio Astronomy (New York: Neale Watson Academic Publications, Inc., 1973), pp. 98-99.

A.B. Crawford, D. C. Hogg, and L. E. Hunt, "Project Echo: A Horn Antenna for Space Communication," Bell System Technical Journal (July 1961), pp. 1095-1099.

2. Marcus Chown, "A cosmic relic in three degrees," New Scientist, September 29, 1988, pp. 51-52.

Richard Learner, Astronomy Through the Telescope (New York: Van Nostrand Reinhold Company, 1981), p. 154.

3. Timothy Ferris, The Red Limit: The Search for the Edge of the Universe, (New York: Quill Press, 1983), p. 141.

4. Herbert Friedman, The Amazing Universe (Washington, DC: National Geographic Society, 1975), p 166-167.

5. Ferris, op. cit., 151.

6. Robert Jastrow, God and the Astronomers (New York: W. W. Norton & Company, Inc., 1978), p. 20.

United States Department of the Interior
National Park ServiceNational Register of Historic Places
Continuation SheetSection number 9 Page 2Bibliography

- Aaronson, Steve. "The Light of Creation: An Interview with Arno A. Penzias and Robert W. Wilson." Bell Laboratories Record. January 1979, pp. 12-18.
- Abell, George O. Exploration of the Universe. 4th ed., Philadelphia: Saunders College Publishing, 1982.
- Asimov, Isaac. Asimov's Biographical Encyclopedia of Science and Technology. 2nd ed., New York: Doubleday & Company, Inc., 1982.
- Bernstein, Jeremy. Three Degree Above Zero: Bell Labs in the Information Age. New York: Charles Scribner's Sons, 1984.
- Chown, Marcus. "A cosmic relic in three degrees," New Scientist, September 29, 1988, pp. 51-55.
- Crawford, A.B., D.C. Hogg and L.E. Hunt. "Project Echo: A Horn-Reflector Antenna for Space Communication," The Bell System Technical Journal, July 1961, pp. 1095-1099.
- Disney, Michael. The Hidden Universe. New York: Macmillan Publishing Company, 1984.
- Ferris, Timothy. The Red Limit: The Search for the Edge of the Universe. 2nd ed., New York: Quill Press, 1978.
- Friedman, Herbert. The Amazing Universe. Washington, DC: National Geographic Society, 1975.
- Hey, J.S. The Evolution of Radio Astronomy. New York: Neale Watson Academic Publications, Inc., 1973.
- Jastrow, Robert. God and the Astronomers. New York: W. W. Norton & Company, Inc., 1978.
- Kirby-Smith, H.T. U.S. Observatories: A Directory and Travel Guide. New York: Van Nostrand Reinhold Company, 1976.
- Lerner, Richard. Astronomy Through the Telescope. New York: Van Nostrand Reinhold Company, 1981.
- Penzias, A.A., and R. W. Wilson. "A Measurement of the Flux Density of CAS A At 4080 Mc/s," Astrophysical Journal Letters, May 1965, pp. 1149-1154.

9. Major Bibliographical References

SEE CONTINUATION SHEET

Previous documentation on file (NPS):

- preliminary determination of Individual listing (36 CFR 67) has been requested
- previously listed in the National Register
- previously determined eligible by the National Register
- designated a National Historic Landmark
- recorded by Historic American Buildings Survey # _____
- recorded by Historic American Engineering Record # _____

See continuation sheet

Primary location of additional data:

- State historic preservation office
- Other State agency
- Federal agency
- Local government
- University
- Other

Specify repository: _____

10. Geographical Data

Acreeage of property _____ less than 1 acre

UTM References

A

1	8
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5	6	9	1	5	0
---	---	---	---	---	---

4	4	7	1	3	2	0
---	---	---	---	---	---	---

Zone Easting

Northing

B

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Zone Easting

Northing

C

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D

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See continuation sheet

Verbal Boundary Description

The boundary extends 50 feet in all directions from the outside walls of the Horn Antenna and the utility shed. (see attached map.)

See continuation sheet

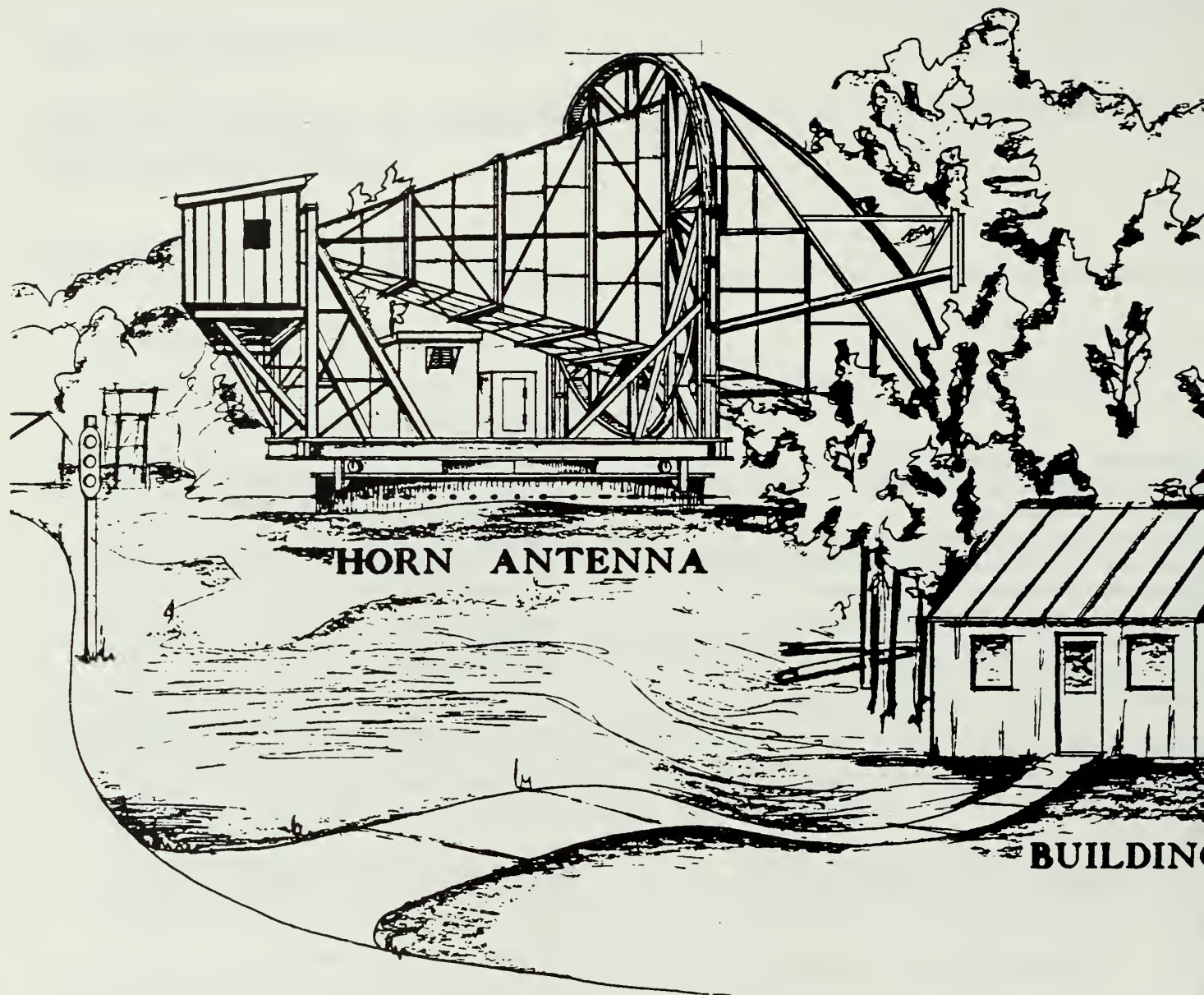
Boundary Justification

The boundary encompasses the entire historic resource included in this nomination form.

See continuation sheet

11. Form Prepared By

name/title Harry Butowsky
 organization National Park Service date May 1, 1989
 street & number 1100 L Street, NW telephone (202) 343-8155
 city or town Washington state DC zip code 20013



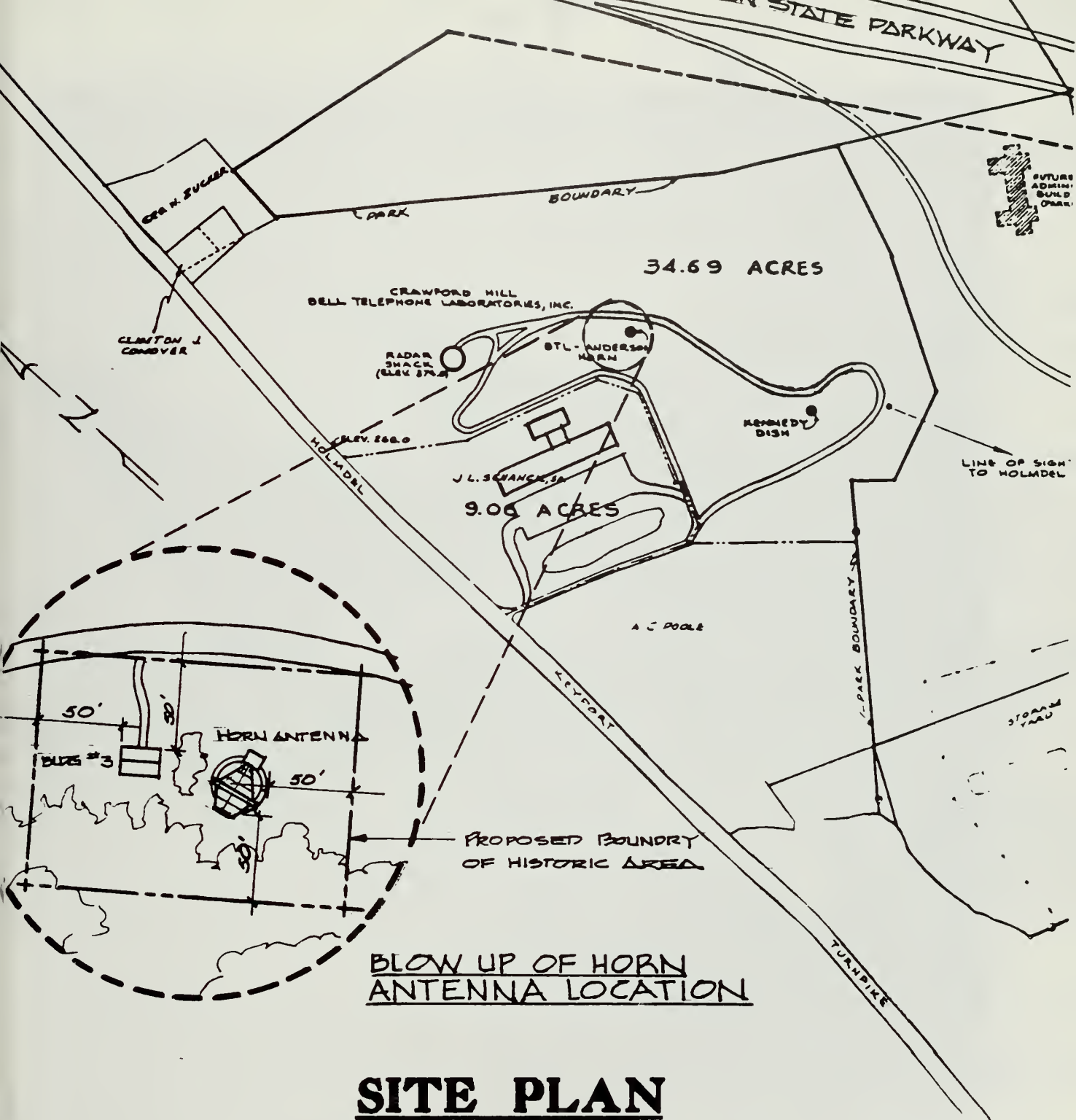
HORN ANTENNA

BUILDING

HORN ANTENNA

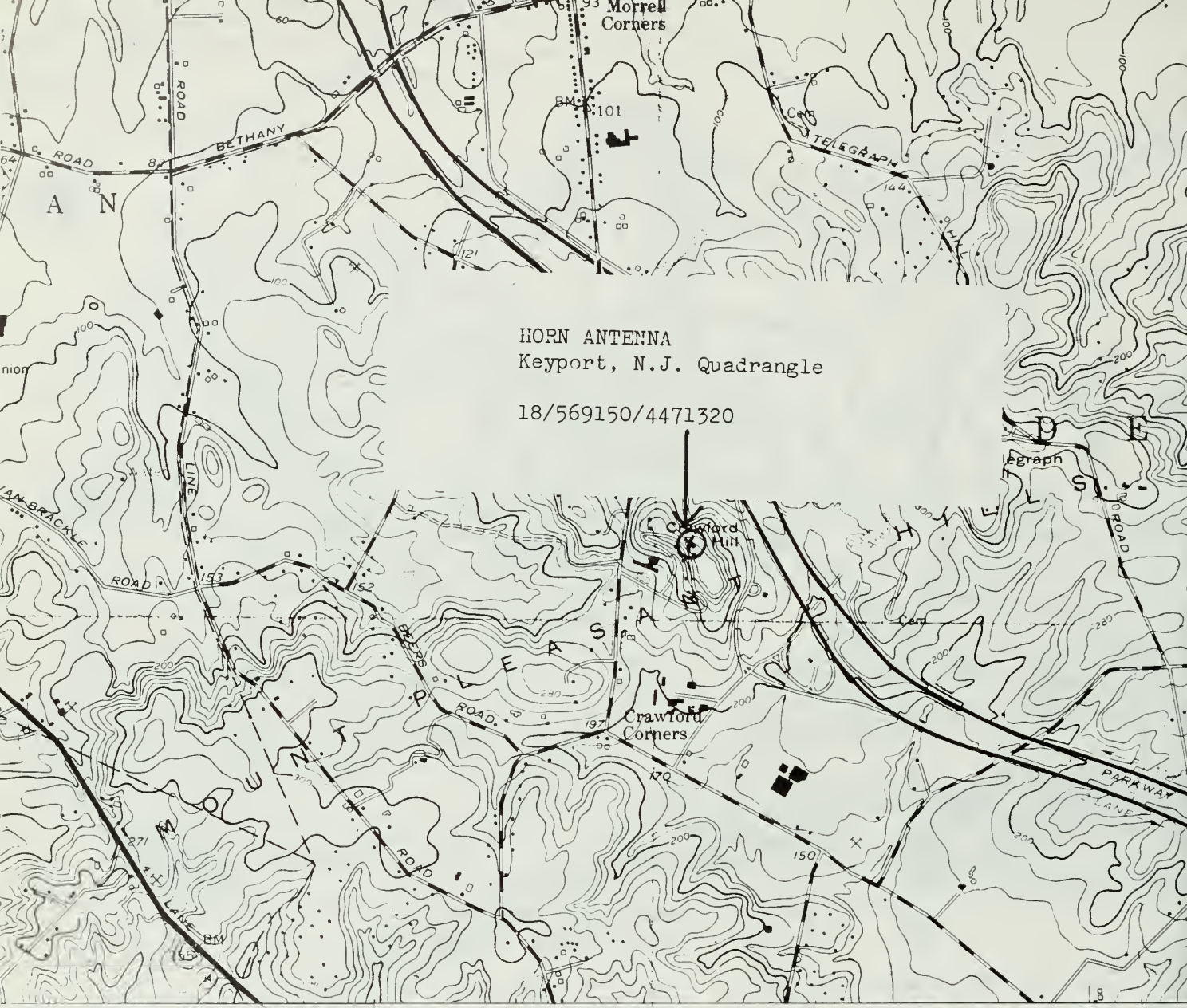
**AT&T BELL LABORATORIES
CRAWFORD HILL FACILITY**

HOLMDEL, NEW JERSEY



SITE PLAN
HORN ANTENNA

AT&T BELL LABORATORIES
CRAWFORD HILL FACILITY
HOLMDEL, NEW JERSEY

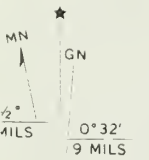
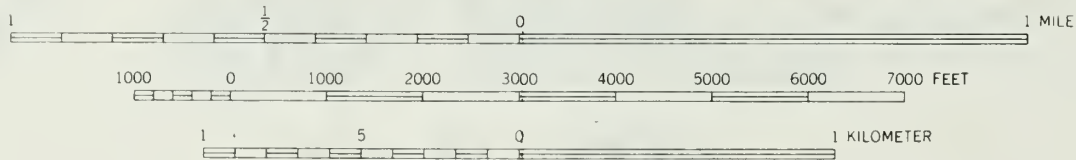


HORN ANTENNA
Keyport, N.J. Quadrangle

18/569150/4471320

567 12'30" 568 (MARLBORO) 570 10' 571
COLTS NECK 5.4 MI COLLENGWOOD PARK (JUNC N J 33) 10 MI

SCALE 1:24000



CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE AVERAGE RANGE OF TIDE IS APPROXIMATELY 4 FEET

FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

IND 1970 MAGNETIC NORTH
ON AT CENTER OF SHEET
Indicates areas in which only
buildings are shown
Inspected 1977. No major
rainage changes observed

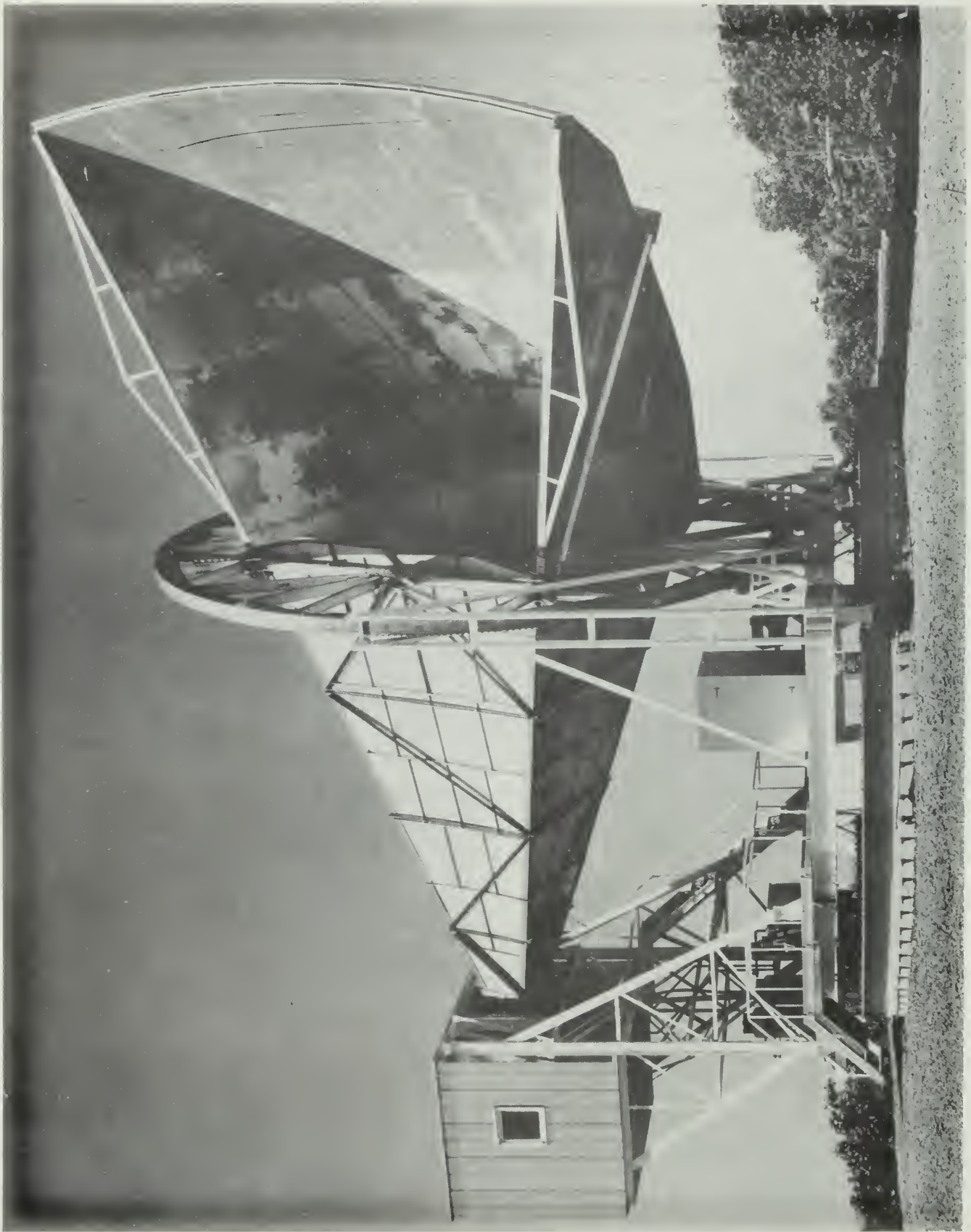
Revisions shown
from photographs
not field checked
Purple tint indica



Horn Antenna — Holmdel, New Jersey

Dr. Robert Wilson (left) and Dr. Arno Penzias (right) in front of the Horn Antenna, 1975

Photo Credit: Bell Labs



Horn Antenna — Holmdel, New Jersey
Horn Antenna, circa 1960

Photo Credit: Bell Labs



Horn Antenna — Holmdel, New Jersey
Rear View of the Antenna and Building #3 1988

Photo Credit: Bell Labs

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

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1. Name of Property

historic name Cincinnati Observatory
other names/site number _____

2. Location

street & number 3435 Observatory Place not for publication
city, town Cincinnati vicinity
state Ohio code OH county Hamilton code 061 zip code 45221

3. Classification

Ownership of Property	Category of Property	Number of Resources within Property	
<input type="checkbox"/> private	<input checked="" type="checkbox"/> building(s)	Contributing	Noncontributing
<input type="checkbox"/> public-local	<input type="checkbox"/> district	<u>2</u>	<u>9</u> buildings
<input checked="" type="checkbox"/> public-State	<input type="checkbox"/> site	_____	_____ sites
<input type="checkbox"/> public-Federal	<input type="checkbox"/> structure	_____	_____ structures
	<input type="checkbox"/> object	_____	_____ objects
		<u>2</u>	<u>9</u> Total

Name of related multiple property listing: _____
Number of contributing resources previously listed in the National Register 11

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of certifying official _____ Date _____
State or Federal agency and bureau _____

In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of commenting or other official _____ Date _____
State or Federal agency and bureau _____

5. National Park Service Certification

I, hereby, certify that this property is:
 entered in the National Register.
 See continuation sheet.
 determined eligible for the National Register. See continuation sheet.
 determined not eligible for the National Register.
 removed from the National Register.
 other, (explain:) _____

Signature of the Keeper _____

Date of Action _____

6. Function or Use

Historic Functions (enter categories from instructions)

Education, Research

Current Functions (enter categories from instructions)

Education

7. Description

Architectural Classification

(enter categories from instructions)

Georgian Revival

Materials (enter categories from instructions)

foundation concrete

walls brick, stone

roof metal domed roof

other stone columns

Describe present and historic physical appearance.

The main building of the University of Cincinnati Observatory is a Georgian Revival building laid out in a "T" plan.¹ The observatory was constructed in 1873. It has a symmetrical facade distinguished by a prostyle portico with interior round fluted columns and rectangular cut rock-faced ashlar stone blocks with margins composing the corner piers and supporting a gable roof with closed pediment having a large circular window in the pediment and capped with an orb. The central entry has large rectangular doors, simple flat stone lintels and is capped with the following inscription:

Cincinnati Observatory
1873

The windows are large and rectangular with 6/6 double hung treatment having simple stone lintels and trim with the sills forming part of a continuous string course. The open portico is reached by climbing a small series of stone steps flanked by a low stone wall. There is a raised water table composed of rock faced-ashlar and capped with a belt course. Small rectangular basement windows break the continuous foundation. The exterior walls are brick with stretcher bond treatment. The roof is highlighted by an iron balustrade with numerous balusters and interior side chimneys.

The distinguishing feature of the building is the large ribbed metal dome painted silver and resting atop a square projection where the frieze has dentils and decorative treatment. The metal dome is "open" in the respect that it protects the viewing room from rain but not from the free movement of air. When observations are conducted, it is necessary that the inside and outside temperatures be equal so as not to create air currents that would obstruct clear astronomical observation. Originally the dome was a "cheese box type," being round on the side and flat on the top. This was removed in 1895 and replaced with the existing dome.

The walls of the central rotunda serve as a series of columns to support the dome with no connection to the telescope pier, except through solid ground.

See continuation sheet

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The telescope pier descends 8-1/2 feet below ground level. The pier is a cone tapered cylinder of brick, 9-1/2 feet in diameter at the base. At the top it supports the cast-iron base of the telescope mounting which is 4-1/2 by 4 feet. At no place does the building touch the central pier, so as not to transmit any vibrations to the telescope; thus the walls are independent of the telescope mounting.

At present the building houses a 16-inch refractor telescope built by Alvan Clark & Sons in 1904. The building is used for offices and has an extensive astronomy library.

O.M. Mitchel Building

The O.M. Mitchel Building, located next to the Cincinnati Observatory, is a rectangular, 5 bay by 4 bay, late Greek Revival style building designed by the Cincinnati architectural firm of Samuel Hannaford and Sons. The symmetrical facade has a portico that is distyle in antis with flat smooth stone pilasters flanking two round smooth stone columns. A small series of steps leads to double doors with an arched transom window. The doorway is surrounded by slightly decorated stone trim capped with a keystone. The stairs are flanked by rock faced ashlar stone walls that evolve into a raised water table capped by a continuous belt course.

The brick wall is composed of common bond. The windows are 1/1 double hung with flat stone voussoirs with keystone and slender stone lugsills. The corners of the building are accentuated by a decorative brick treatment. The building has a parapet entablature with dentils and capped with a low pediment with decorative finial. The parapet is capped with stone. The original portion of the building, having the larger domed turret and smaller cone turret, was built in 1904; the front part, designed to house a meeting room and library, was completed in 1908.

The O.M. Mitchel Building was constructed in 1904 to house the original 11-inch refractor installed at the Cincinnati Observatory in 1845. When originally installed in 1845 this was a 12-inch lens. Later observations confirmed suspected errors in the lens and in 1876 the lens was refigured by Alvan Clark & Sons as an 11-inch lens. The refractor is now used for night educational observations.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

nationally statewide locally

Applicable National Register Criteria A B C D NHL Criteria 1

Criteria Considerations (Exceptions) A B C D E F G

Areas of Significance (enter categories from instructions)

National Register Significance
Education, Science

National Historic Landmark: Science:
Subtheme: Physical Science, Facet:
Astronomy

Period of Significance

1843-Present

Significant Dates

1843-Present

Cultural Affiliation

N/A

Significant Person

Ormsby MacKnight Mitchel

Architect/Builder

Samuel Hannaford and Sons/Observatory
Ormsby MacKnight Mitchel/Building

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

Summary

The Cincinnati Observatory is one of the oldest functioning observatories in the United States. Founded in 1843 it was located on Mount Adams until 1873, when it was moved to its present site on Mount Lookout, just off Observatory Avenue, in Cincinnati. The present observatory building dates from 1873.

The Cincinnati Observatory was the first fully equipped observatory in the midwest and is associated with the productive careers of such famous American astronomers as Ormsby MacKnight Mitchel (1809-1862) who published the Sidereal Messenger, the first attempt to bring astronomy to the masses in the United States, and Paul Herget (1908-1981) who was the world's foremost authority on the computation of planetary orbits.

In addition, the Cincinnati Observatory is associated with Cleveland Abbe (1838-1916), a meteorologist who began to issue daily weather bulletins in 1869. Abbe's work proved so popular with the American public that steps were taken to establish a permanent government institution to continue this service--the United States Weather Bureau.

History

On November 9, 1843, ex-President John Quincy Adams, 77 years old, gave the dedication address and laid the cornerstone of the observatory. The hilltop where the original observatory was located became known as Mount Adams. By June 1845 the building was complete and its telescope in place. Ormsby MacKnight Mitchel was appointed as the first director of the observatory. Under his leadership, the observatory was utilized for astronomical research and for general viewing and educational purposes. From 1843 to the start of the Civil War, the Cincinnati Observatory was reputed to be the best equipped in the United States and Mr. Mitchel stood among the notable astronomers of the world.

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Section number 8 Page 2

Having graduated from West Point in 1829, (in the class which included Robert E. Lee), Mitchel became an enthusiastic supporter of the North when the Civil War broke out. He had kept himself involved with the army since his graduation and, after several successful campaigns, became a Major General in 1862. He died that year of yellow fever.

After his death, the observatory continued with several other directors. Cleveland Abbe, director from 1868 to 1870, established a system of daily weather reports and storm predictions, having secured the cooperation of observers stationed at various points throughout the country making observations at specific times and telegraphing their information to Cincinnati. Professor Abbe then used this information to issue daily weather bulletins. This service proved so popular with the public that the Federal Government initiated the United States Signal Service, headed by Professor Abbe, to continue weather observations. This work eventually led to the establishment of the United States Weather Bureau (now NOAA, the National Oceanic and Atmospheric Administration).

By 1870 the City of Cincinnati's growth and development had overtaken the once open location of the observatory and, because of smoke and other visual factors, the Mount Adams location had become unsuitable for serious astronomical research.

In 1872 the Observatory became part of the University of Cincinnati and plans were established to continue the research and educational aspects at a different location. Mr. John Kilgour, a successful businessman, donated four acres of land and \$10,000 towards the construction of a new observatory and equipment. Additional funds were secured and the new observatory was erected at Mount Lookout in 1873. The original cornerstone was relaid and reads as follows:

This Cornerstone
was laid by
John Quincy Adams
Nov. 9, 1843
Removed and Relaid
MDCCCLXXIII

On the adjoining side the stone reads:

Cincinnati Astronomical Society
Founded
May A. D. 1842

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During the 20th century, the Cincinnati Observatory continued to play an important role in the history of astronomy due to its association with the productive career of astronomer Paul Herget (1908-1981), who began his work there as an assistant to the director of the observatory in 1931.

By 1931 the 11-inch and newer 16-inch refractors were not significant research instruments any longer, and the main program of the observatory was the accurate meridian-circle measurements of the positions of stars to determine their proper motions. On the recommendation of his mathematics professor, Paul Herget was hired to reduce these observations.

Paul Herget's research centered around orbit computations and the use of computer programs. Herget built his research on the work of Cincinnati mathematician Louis Brand, who emphasized the power of vectors to express complicated mathematical formulae in simple terms. Starting in 1936 Herget began to work on the determination of the orbits of the asteroids, one at a time. In his research he first used old hand-operated mechanical desk calculators, but within a few years he began to make his observations on punched cards so that all computations could be carried out on punched-card equipment.

With the advent of World War II, Herget went to work at the Nautical Almanac Office at the U.S. Naval Observatory, where he arranged for the acquisition of an IBM tabulator, summary punch, and sorter to prepare the Air Almanac. During this time Herget worked at night and in his spare time to perform the mathematical calculations for a "submarine book" for the Navy. Herget used his experience, gained at Cincinnati on the computation of orbits, to figure out a method of tracking down German submarines on patrol in the Atlantic.

By 1943 the allies had 108 listening posts around the world that could pick up enemy radio signals. Since German submarines would radio their headquarters when they sighted Allied convoys, Herget tabulated the solutions to a quarter of a million spherical triangles, needed to pinpoint the locations of submarines to within five miles. Once this information was known, destroyers could quickly locate and destroy enemy submarines. After Herget's submarine book was printed and distributed to the Navy, Allied losses to German submarines declined dramatically. This work by Herget contributed significantly to the winning of the Battle of the Atlantic during World War II.

After the war Herget returned to the Cincinnati Observatory to continue his research on the orbit computations of the minor planets and the use of computer programs. By 1947, with the support of the International Astronomical Union, Herget established the Minor Planet Center at the Cincinnati Observatory. Based upon his observations, dating back to 1939 and recorded on punched cards, Herget was able to compute the orbits of the minor planets on punched-card

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equipment and later on computers. From 1947 to 1978 when he retired, the Cincinnati Observatory published 4,390 Minor Planet Circulars for the larger astronomical community.

Over the years, Paul Herget became well known as an outstanding practitioner of a very specialized but highly important branch of astronomy. His orbit calculations were widely known, trusted and used. He was not only an expert at numerical computation, but a skilled theoretician with the insight necessary to cast practical astronomical problems into forms well suited for the newly emerging computer technology of the 1940s and 1950s. During his lifetime, Herget converted the Cincinnati Observatory, at a poor site, without a large telescope or significant funding, into an important research center, known throughout the world for its scientific achievements.

In 1979 the observatory formally became part of the Physics Department of the University of Cincinnati. Since that time, the observatory has remained in operation, mainly as a public facility to promote interest and understanding of astronomy through regularly scheduled public lectures and telescope viewing sessions. The 11-inch refractor that Mitchel originally installed in the observatory in 1845 and the later 16-inch refractor are used as educational tools and are enjoyed by thousands of students and visitors every year.

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Footnotes

1. Most of the material in this form was adapted from the following sources:

Fred Mitchell, "National Register of Historic Places Inventory-Nomination Form--Observatory Historic District." (Cincinnati, Ohio: Miami Purchase Association, 1976).

Donald E. Osterbrock and P. Kenneth Seidelmann, "Paul Herget: January 30, 1908--August 27, 1981," Biographical Memoirs of the National Academy of Sciences, (Washington, DC: National Academy of Sciences, 1987), Vol. 57, pp. 59-86.

David Baab, Mike Habel and Arch Pelley, "The Cincinnati Observatory-- Birthplace of the United States Weather Service." (Unpublished student paper, Historic Preservation Lab, University of Cincinnati, 1978.)

No Author, "The Historical Significance of the Cincinnati Observatory." (Unpublished paper, no date.)

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Bibliography

- Abell, George O. Exploration of the Universe. 4th ed., Philadelphia: Saunders College Publishing, 1982.
- Asimov, Isaac. Eyes On The Universe. Boston: Houghton Mifflin Company, 1975.
- Baab, David; Mike Habel, and Arch Pelley, "The Cincinnati Observatory-- Birthplace of the United States Weather Service." Unpublished student paper, Historic Preservation Lab, University of Cincinnati, 1978.
- Historical and Philosophical Society of Ohio and the University of Cincinnati, The Centenary of the Cincinnati Observatory. Cincinnati, 1944.
- Kirby-Smith, H.T. U.S. Observatories: A Directory and Travel Guide. New York: Van Nostrand Reinhold Company, 1976.
- Learner, Richard. Astronomy Through the Telescope. New York: Van Nostrand Reinhold Company, 1981.
- Mitchell, Fred. "National Register of Historic Places Inventory-Nomination Form--Observatory Historic District." Cincinnati, Ohio: Miami Purchase Association, 1976.
- No Author. "The Historical Significance of the Cincinnati Observatory." Unpublished paper, no date.
- Osterbrock, Donald E., and Kenneth P. Seidelmann. "Paul Herget: January 30, 1908--August 27, 1981," Biographical Memoirs of the National Academy of Sciences. Washington, DC: National Academy of Sciences, 1987, Vol. 57, pp. 59-86.
- Weddle, Kevin J. "Old Stars: Ormsby Mitchel," Sky and Telescope Magazine, January 1986, pp. 14-16.
- Woodward, Charles. "Two Cincinnati Astronomers, Ormsby M. Mitchel and Paul Herget," Bulletin of the Cincinnati Historical Society, April 1966, pp. 164-87.

9. Major Bibliographical References

See Continuation Sheet

Previous documentation on file (NPS):

- preliminary determination of individual listing (36 CFR 67) has been requested
- previously listed in the National Register
- previously determined eligible by the National Register
- designated a National Historic Landmark
- recorded by Historic American Buildings Survey # _____
- recorded by Historic American Engineering Record # _____

See continuation sheet

Primary location of additional data:

- State historic preservation office
- Other State agency
- Federal agency
- Local government
- University
- Other

Specify repository: _____

10. Geographical Data

Acreage of property 10.4

UTM References

A 1 6 7 2 2 8 2 0 4 3 3 5 2 0 0
Zone Easting Northing

B 1 6 7 2 2 8 2 0 4 3 3 5 2 0 0
Zone Easting Northing

C 1 6 7 2 2 8 0 0 4 3 3 4 9 8 0

D 1 6 7 2 2 7 4 0 4 3 3 4 9 6 0

E. 16 722740 4334960

F. 16 722700 4335000

See continuation sheet

Verbal Boundary Description: Beginning at the intersection of Observatory Place and the north line of observatory Avenue; thence easterly along the north line of Observatory Avenue for approximately 130'; thence north along the property line for 150'; thence east for 50'; thence north for 125'; thence east for 125'; thence east for 75'; thence north for 65'; thence east for 78'; thence north for 430'; thence west for 567'; thence south for 804'; thence east for 90'; thence south for 100'; to the north line of Observatory to the point of beginning.

See continuation sheet

Boundary Justification

This is the original boundary of the Cincinnati Observatory Historic District.

See continuation sheet

11. Form Prepared By

name/title Harry Butowsky

organization National Park Service

date May 1, 1989

street & number 1100 L Street, NW

telephone (202) 343-8155

city or town Washington

state DC

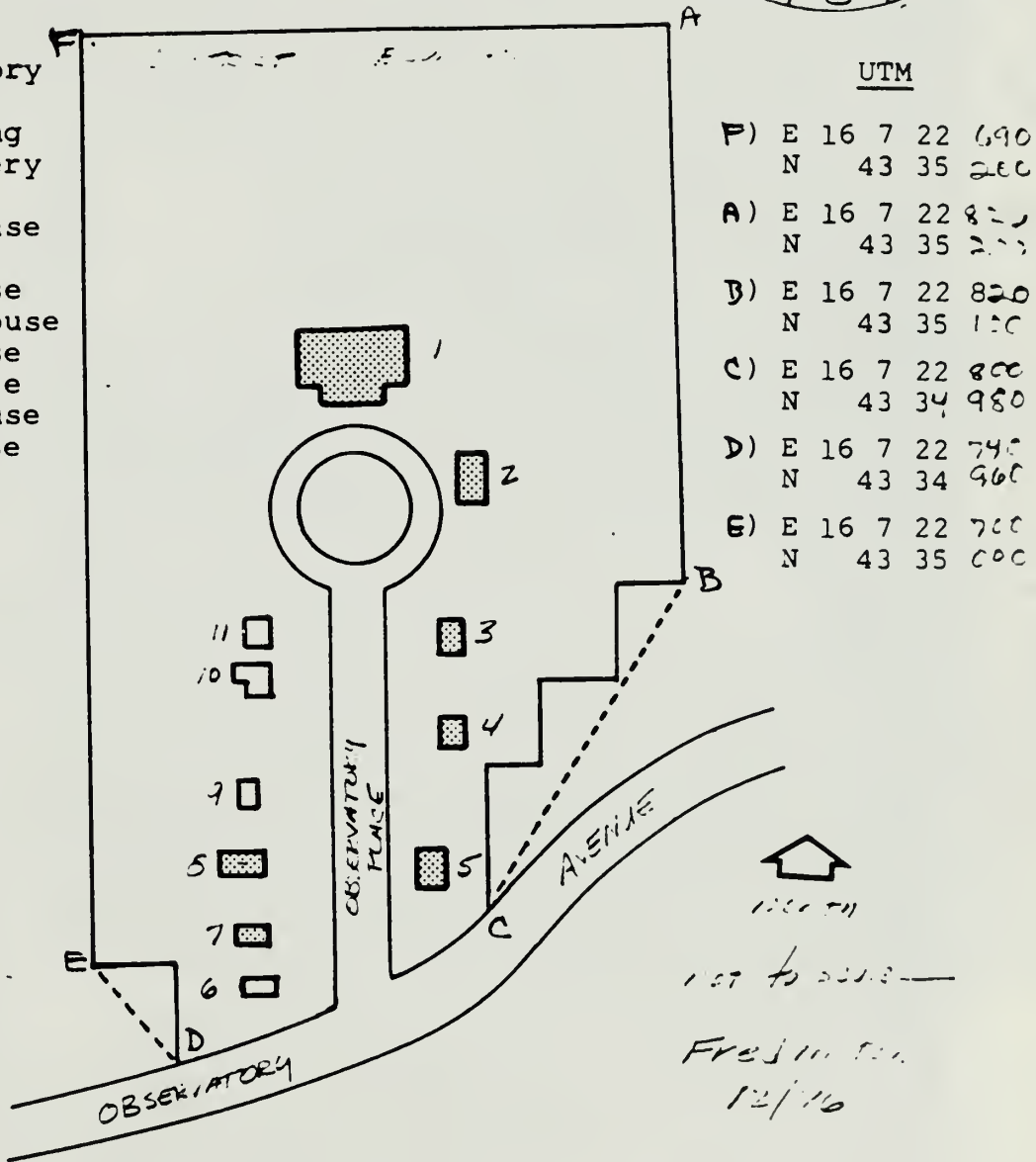
zip code 20013

OBSERVATORY HISTORIC DISTRICT

3290 - 3300 Observatory Avenue
 3435 - 3459 Observatory Place
 Cincinnati Observatory Building



- 1) Cincinnati Observatory Building
- 2) O.M. Mitchel Building
- 3) John & Elma Montgomery House
- 4) Robert A. Stoehr House
- 5) Ormond Stone House
- 6) Virgil T. Wyatt House
- 7) Jermain G. Porter House
- 8) Thomas S. Shore House
- 9) Nicholas Browne House
- 10) Walter I. Farmer House
- 11) Elma Montgomery House



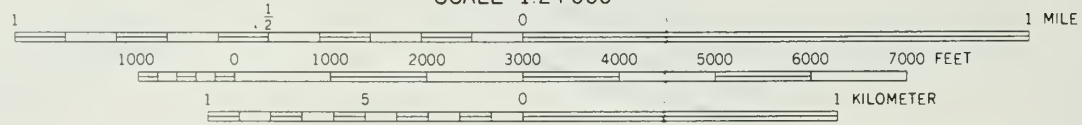


UNIVERSITY OF CINCINNATI OBSERVATORY
Cincinnati East, Ohio Quadrangle

- A. 16/722820/4335200
- B. 16/722828/4335200
- C. 16/722800/4334980
- D. 16/722470/4334960
- E. 16/722740/4334960
- F. 16/722700/4335000

2 T 3 R 2 T 4 27' 30" 720 (NEWPORT) 721 722 0.4 MI. TO U.S. 50 25' CINCINNATI
4162 III SW

SCALE 1:24 000



CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

1981 MAGNETIC NORTH
IN AT CENTER OF SHEET

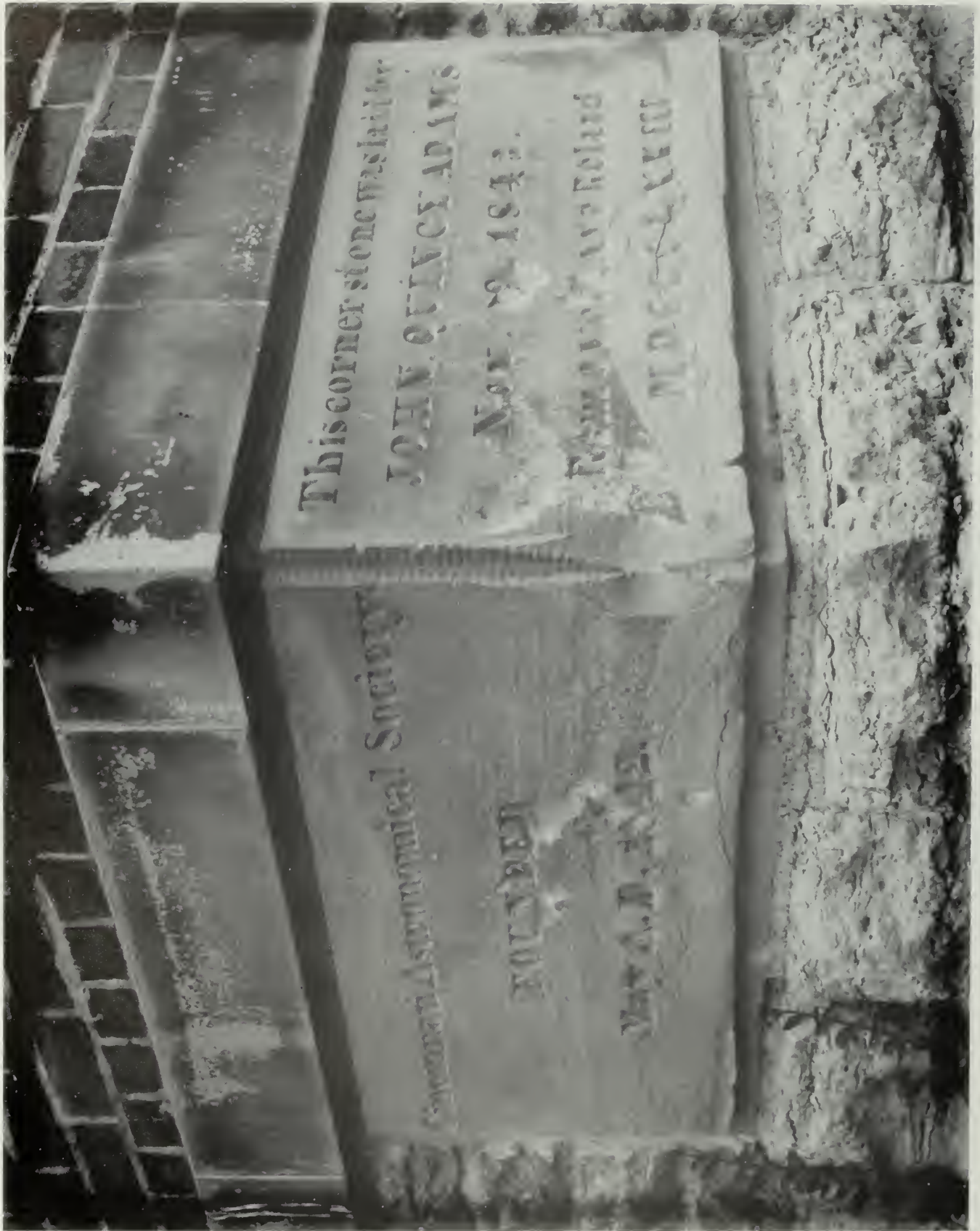
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY
DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

Revisions shown in purple
with State of Ohio flag
and other sources. *1
Purple tint indicates



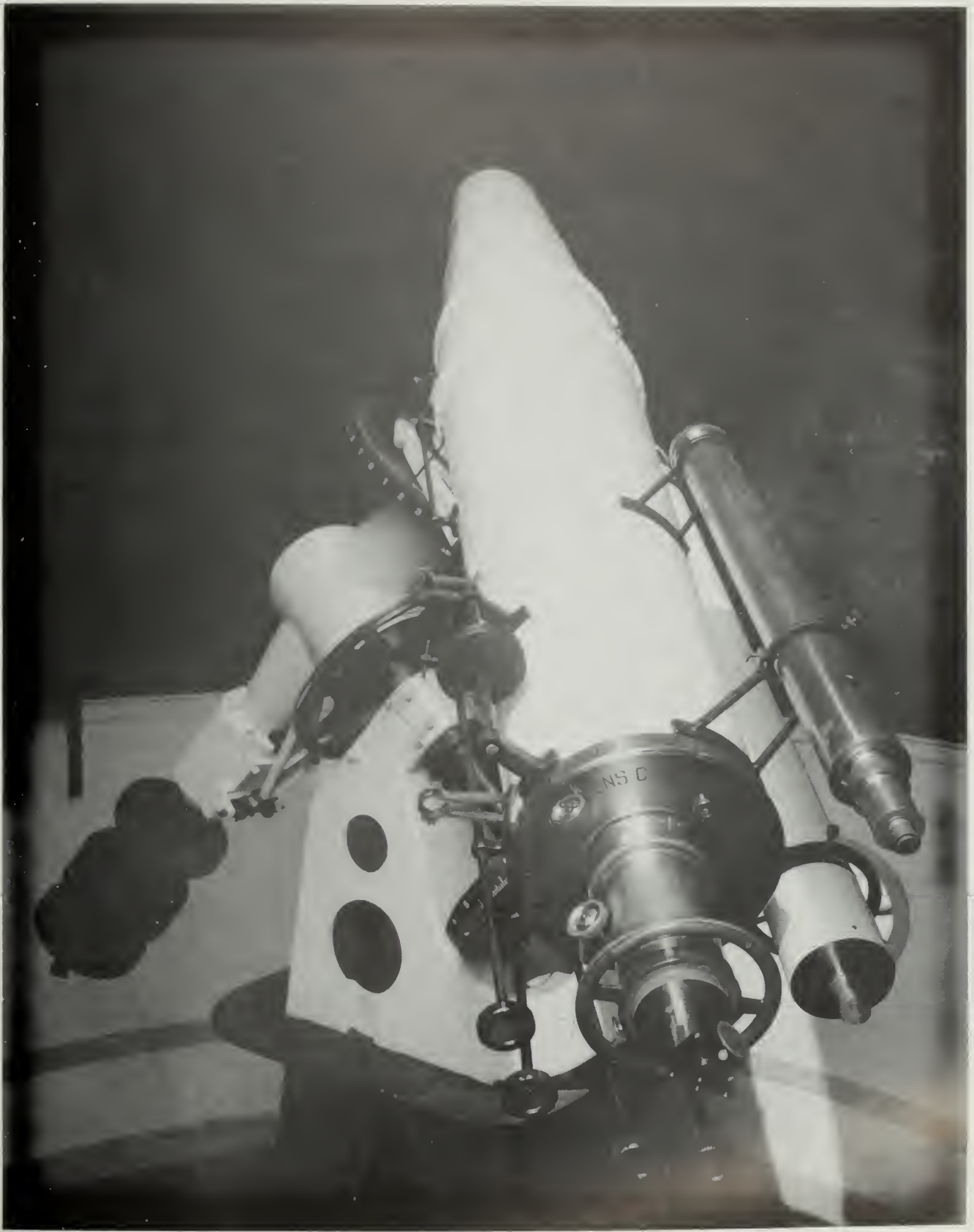
Cincinnati Observatory — Cincinnati, Ohio
Exterior View of the Cincinnati Observatory, 1988

Photo Credit: Cincinnati Observatory



Cincinnati Observatory — Cincinnati, Ohio
Original Corner Stone of the Cincinnati Observatory, 1988

Photo Credit: Cincinnati Observatory



Cincinnati Observatory — Cincinnati, Ohio
16-inch Refractor Telescope, 1988

Photo Credit: Cincinnati Observatory



Cincinnati Observatory — Cincinnati, Ohio
Front View of the O.M. Mitchel Building, 1938

Photo Credit: Cincinnati Observatory



Cincinnati Observatory — Cincinnati, Ohio
11.5-inch Mitchel (Refractor) Telescope, 1938

Photo Credit: Cincinnati Observatory

United States Department of the Interior National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in Guidelines for Completing National Register Forms (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name Allegheny Observatory other names/site number

2. Location

street & number not for publication city, town 159 Riverview Avenue vicinity state Pittsburgh code PA county Allegheny code 003 zip code 15214

3. Classification

Ownership of Property: private, public-local, public-State, public-Federal. Category of Property: building(s), district, site, structure, object. Number of Resources within Property: Contributing (1), Noncontributing (buildings, sites, structures, objects), Total (1). Name of related multiple property listing: Number of contributing resources previously listed in the National Register

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property meets does not meet the National Register criteria. See continuation sheet. Signature of certifying official Date State or Federal agency and bureau

In my opinion, the property meets does not meet the National Register criteria. See continuation sheet. Signature of commenting or other official Date State or Federal agency and bureau

5. National Park Service Certification

I, hereby, certify that this property is: entered in the National Register. determined eligible for the National Register. determined not eligible for the National Register. removed from the National Register. other, (explain:)

Signature of the Keeper Date of Action

6. Function or Use

Historic Functions (enter categories from instructions)

Education, Research

Current Functions (enter categories from instructions)

Education, Research

7. Description

Architectural Classification

(enter categories from instructions)

Classical Revival

Materials (enter categories from instructions)

foundation concrete

walls stone, brick

roof metal dome

other stone, columns

Describe present and historic physical appearance.

The Allegheny Observatory is a large Neoclassical structure consisting of a first floor level and basement, on the wooded hills above the north bank of the Ohio River, in Riverview Park, Pittsburgh, Pennsylvania.¹ The building was designed by architect Thorsten E. Billquist, and built (1900-12) to be large enough to accommodate new discoveries and equipment in the field of astronomy. Billquist worked closely with astronomer James E. Keeler and telescope maker John Alfred Brashear in its design.

The shape of the observatory building resembles a basilica, with a large rectangular block with two semi-circular rooms surmounted by two small domes flanking the entranceway, and a long hallway leading to a larger dome set at the opposite end. Designed to house three large telescopes, the three circular sections and domes dominate the facade and layout of the Allegheny Observatory.

The main entrance is covered by a pedimented portico supported by two Ionic columns. Double windows with plain flat frames and raised stone labels are located on either side of the doorway. The two smaller domes lie at the ends of this front facade. The left dome is surrounded by a stone porch supported by Ionic columns. Large plain windows line the walls of this section and smaller square windows are located directly under the dome. The right dome is plain and has only small rectangular slit-like windows.

The flat temple-like roof, pedimented entranceway and simple columns add to the classical appearance of the building. Decorative cut-out stonework forms a border along the roofline. The names of famous astronomers are cut into the lower cornice stone work just below the roofline.

With the completion of the building in 1912 the observatory was equipped with three primary telescopes--a 13-inch Fitz-Clark refractor, the 30-inch Thaw refractor, and the 31-inch Keeler Memorial reflecting telescope. The 13-inch Fitz-Clark refractor, found in the small dome to the left of the front doorway, is today used primarily for public viewing during the observatory's evening

See continuation sheet

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tours. It is also used to test new auxiliary equipment for the other instruments. The 30-inch Thaw refractor housed in the main dome of the observatory is the largest photographic refractor in the country and was especially designed for photographic astrometry. The telescope tube is 47 feet long and weighs 8,000 pounds. The Thaw is used primarily to take 8 x 10-inch stellar photographs which are used in positional astronomy. In 1985 the original 30-inch glass lens in the Thaw telescope, made by John Brashear, was replaced with a new lens, designed to collect more light in the red end of the spectrum to cope with the increasing problem of light pollution in the Pittsburgh area. The original 30-inch lens is now on display in the main corridor of the observatory building. The 31-inch Keeler Memorial reflecting telescope, found in the small dome to the right of the front doorway, is used to photograph the spectra of the stars and to study double and multiple star systems.

Astronomer and physicist, James Edward Keeler (1857-1900), his son Henry Rowman Keeler (1893-1918), and telescope maker and former director of the Allegheny Observatory, John A. Brashear (1840-1920) and his wife Phoebe S. Brashear (1843-1910), are buried in vaults in the basement pier of the 31-inch Keeler Memorial reflecting telescope. A lifesize bronze statue of John Brashear, by Pittsburgh sculptor E. Victor, is on display in the main hallway on the first floor of the observatory.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

nationally statewide locally

Applicable National Register Criteria A B C D NHL Criteria 1,2

Criteria Considerations (Exceptions) A B C D E F G

Areas of Significance (enter categories from instructions)

National Register Significance:

Education, Science

National Historic Landmark: Science,

Subtheme: Physical Science, Facet:

Astronomy.

Period of Significance

1858-Present

Significant Dates

Cultural Affiliation

Significant Person

John Alfred Brashear

Architect/Builder

Thornsten E. Billquist

Samuel Pierpont Langley, James Edward Keeler

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

Summary

The Allegheny Observatory at the University of Pittsburgh is significant because of its association with the careers of astronomers Samuel Pierpont Langley (1834-1906), James Edward Keeler (1857-1900), and telescope maker John Alfred Brashear (1840-1920).²

Langley was professor of astronomy and physics at the University from 1867 to 1887 and director of the Allegheny Observatory. During that time Langley invented the bolometer and used it in 1878 to make spectral observations of solar and lunar radiation. His paper on The Bolometer and Radiant Energy (1881) became a scientific classic. While Langley was the director, the Allegheny Observatory was the leading American observatory on matters relating to the study of solar physics.

James Edward Keeler succeeded Langley as director of the Allegheny Observatory and used the 13-inch Fitz-Clark refractor with a spectroscope to show, in 1895, that the rings of Saturn were rotating as a unit but that the inner boundary had a considerably shorter period than the outer. This was the first observational evidence that the rings were not solid but consisted of discrete particles circling the planet at different speeds.

John Alfred Brashear was named acting director of the Allegheny Observatory after Keeler's departure for the Lick Observatory in 1898. Brashear was a self-taught optician whose service to astronomy began in 1876 when he began to make astronomical telescopes. Over the years of his active career Brashear not only made both of the larger telescopes used at the Allegheny Observatory, but came to be recognized as one of the best telescope makers of his day. In the years since Brashear's death in 1920 the Allegheny Observatory has used his telescope (the Thaw refractor) to do fundamental work in the field of astrometry, including the search for stars whose oscillations betray the presence of invisible companions.

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History

The Allegheny Observatory was established in the wake of the appearance of Donati's Comet of 1858 when several prominent Pittsburgh businessmen formed the Allegheny Telescope Association. They purchased a 13-inch Fitz refractor, at that time the third largest telescope in the country, and built an observatory on the Northside hill in Pittsburgh, Pennsylvania. In 1867 the Allegheny Observatory was transferred to the Western University of Pennsylvania, the forerunner of the University of Pittsburgh. The observatory became the home of the University of Pittsburgh Department of Astronomical Science.

Samuel Pierpont Langley was appointed as the first salaried director of the Allegheny Observatory. Langley was all but unknown when he arrived at the Allegheny Observatory in 1867, but when he left 20 years later he was world famous for his scientific achievements. During his term as director of the Allegheny Observatory he devised the "Allegheny System" of time keeping, which was based on measurements of star positions, and partially supported the observatory by selling accurate time signals to the railroads and the cities of Allegheny and Pittsburgh.

Langley devised his time-keeping service as a source of income for the Allegheny Observatory. While not the first time-keeping service in the country, it was the first to turn a considerable profit. During his administration, the time-keeping service earned more than \$60,000 and other observatories soon began to follow Allegheny's example.

Langley saw in his time service the means for establishing a national standard of uniform time. The Pennsylvania Railroad and its many subsidiaries were the most influential customers of the Allegheny Observatory's time-keeping service. In 1870 the Pennsylvania system extended some 2,500 miles and had some 300 telegraph offices receiving time signals. Eventually more than 8,000 miles of railway ran to the ticking of the time signals of the Allegheny Observatory. This uniform time service was not only profitable but necessary for the safe operation of the railroad. Timetables not only dictated train arrivals and departures, but, in the days before automatic signaling, also ensured that two trains did not meet head-on on the same stretch of single-line track. The system of uniform standard railway time became popular with the general public and led to the establishment of Standard Railway Time in 1883, and by 1918, the establishment of universal standard time.

Among Langley's other accomplishments was the study of sunspots with the 13-inch Fitz refractor, by then reworked by American astronomer Alvan Graham Clark (1832-1897), and the development of the bolometer to measure the amount of heat the sun radiated at different wavelengths. He used this instrument to make

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careful measurements of the quantity of solar radiation, both in the visible and invisible portions of the solar spectrum. In the process, he extended the knowledge of the solar spectrum into the far infrared for the first time. A unit of radiation equal to one calorie per square centimeter is called one langley in his honor. In 1887 Langley left the Allegheny Observatory to become the Secretary of the Smithsonian Institution in Washington, DC.

Langley's successor was James Edward Keeler, an astronomer and physicist who would serve as the director of the Allegheny Observatory from 1891 to 1897. During his time at Allegheny, Keeler used the 13-inch Fitz-Clark refractor with a spectroscope to show that the rings of Saturn were not solid but are made up of particles circling the planet. This observation confirmed earlier theories proposed by Italian astronomer Giovanni Domenico Cassini (1625-1712) and Scottish physicist James Clerk Maxwell (1831-1879). With George Ellery Hale (1868-1938) Keeler founded the Astrophysical Journal, which became one of the leading professional astronomical journals. Keeler left the Allegheny Observatory in 1898 for the Lick Observatory in California. After Keeler's untimely death in California in 1900, his ashes were returned to the Allegheny Observatory for burial in a vault in the basement pier supporting the Keeler Memorial reflecting telescope.

John Brashear was named as the acting director of the observatory while Keeler's replacement was being sought. Brashear's service to astronomy began in 1876 when he first showed Langley a lens he had made. Impressed, Langley encouraged Brashear's lens making, and finally introduced him to William Thaw, a railroad businessman, who agreed to support Brashear in the making of telescope lenses. With Thaw's financial support and Langley's encouragement, Brashear soon developed into one of the finest lens makers in the country. His lenses and mirrors are still found in many of the major refracting and reflecting telescopes in the world today.

After Brashear demonstrated his competence and all-around skill with optical instruments, he formed a business partnership with physicist Henry A. Rowland (1848-1901), of Johns Hopkins University, to manufacture gratings for spectroscopy. To give good spectra and get the most out of available light, a grating must be ruled with all of its grooves accurately parallel, and exactly evenly spaced. The larger a grating, the more efficient it is, but at the same time the more difficult it is to make. Rowland had developed in his laboratory at Johns Hopkins University a machine, Rowland's Ruling Engine, with which he could make gratings far superior to any previously known. Typically, his gratings would be several inches in diameter, ruled with 14,436 grooves per inch. These gratings revolutionized the study of spectroscopy, and astronomers everywhere clamored for them. These gratings, known as Rowland Diffraction Gratings, had a very accurate surface, no error of even 1/200,000th of an inch being allowed. Brashear supplied the accurately flat speculum-metal blanks, on

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which the gratings were ruled. Brashear's flat speculum-metal blanks when coupled with Rowland's Ruling Engine, produced diffraction gratings that supplied an invaluable tool to astronomers and physicists in the study of spectroscopy.

Another of Brashear's accomplishments was to arranged for David C. Park, a founder of Crucible Steel, to donate a plot of land in Riverview Park, in Pittsburgh, as the new location for the Allegheny Observatory. He also raised more than \$300,000 to fund the construction of the new building. In addition, Brashear solicited Mrs. William Thaw, Jr., for additional funds to build a large 30-inch refractor dedicated to the memory of her husband and father-in-law. Brashear, personally, designed and built the 30-inch Thaw refractor. On October 20, 1900, the corner stone of the new observatory was laid. Designed in the Classical style by the architect Thorsten E. Billquist, the new observatory was to be not only extremely functional but the beautiful focal point of the surrounding Riverview Park. When completed in 1912 the observatory was in possession of three major telescopes for its research program: the 13-inch Fitz-Clark refractor, the 30-inch Thaw refractor, and the 31-inch Keeler Memorial reflecting telescope.

In the years since the completion of the new building in 1912 the most important research work of the observatory staff has been in the area of astrometry. The telescope associated with this research is the 30-inch Thaw refractor. Large refractors are highly useful for this type of astronomical research because after their objectives have been installed they can be left undisturbed for decades. Any shift of one star with respect to its neighbors, barely measurable on photographic plates taken many years apart, is thus more surely a real displacement of the star and not some change in the condition of the optics.

The 30-inch Thaw refractor was designed by Brashear for this specialized area of research, photographic astrometry--the determination of the positions of celestial objects with great precision using photographs. The Thaw is the most successful telescope of this type in the world. For the last 75 years, it has been used to obtain data in three important areas. With it, astronomers have measured the distances to over 2,500 stars, or roughly 40 percent of all known stellar distances. It is also used to study the orbital motions of stars around each other and to determine the masses of stars. Finally, the Thaw is used in the search for planets revolving around stars; it is one of the few instruments in the world accurate enough to do such work.

In the years since 1912 the Allegheny Observatory has amassed a collection of more than 110,000 parallax plates resulting from observations with the Thaw telescope. This vast collection of data bearing the images of various star fields represents a continuity of information unmatched anywhere in the world.

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By using this collection of photographic plates and new technologies such as the Multichannel Astronomic Photometer (MAP), the Allegheny Observatory has remained in the forefront of research in the important field of astrometry. Indeed, through the use of repeated observation with the Thaw and the MAP, the Allegheny Observatory can compare this information with the wealth of data in its plate library, and offer the best chance astronomers have at present for observing extrasolar planets.

The Allegheny Observatory represents an important site associated not only with significant men in the history of the science of astronomy, Samuel Pierpont Langley, James Edward Keeler, and John Brashear, but also represents an important research institution where the instruments and data of the past are today coupled with the latest technologies, to continue the process of making new discoveries that are in the very forefront of astronomical research.

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National Park Service

National Register of Historic Places Continuation Sheet

Section number 8 Page 6

Footnotes

1. The descriptive material for this section was taken from the following sources:

Susan M. Zacher, "National Register of Historic Places Inventory-Nomination Form--Allegheny Observatory." (Harrisburg, Pennsylvania: Pennsylvania Historical and Museum Commission, 1979).

The Allegheny Observatory of the University of Pittsburgh (Pittsburgh, Pennsylvania: University of Pittsburgh, no date). (Brochure)

2. The material for the statement of significance was taken from the following sources:

Zacher, op. cit.

Donald E. Osterbrock, James E. Keeler: Pioneer American astrophysicist (Cambridge, England: Cambridge University Press, 1984), pp. 107-152.

Allen Johnson, ed., "John A. Brashear," Dictionary of American Biography (New York: Charles Scribner's Sons, 1943), II: 605-606.

Carlene E. Stephens, Inventing Standard Time (Washington, DC: Smithsonian Institution, 1983).

Roger W. Sinnott, "The Wandering Stars of Allegheny, " Sky and Telescope, October 1987, pp. 360-363.

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Section number 9 Page 2

Bibliography

Abell, George O. Exploration of the Universe. 4th ed., Philadelphia: Saunders College Publishing, 1982.

Asimov, Isaac. Asimov's Biographical Encyclopedia of Science and Technology. 2nd ed., New York: Doubleday & Company, Inc., 1982.

_____. Eyes On The Universe. Boston: Houghton Mifflin Company, 1975.

Brashear, John A. The Autobiography of a Man Who Loved the Stars. New York: Houghton Mifflin Co., 1925.

Croswell, Ken. "Does Barnard's Star Have Planets?" Astronomy Magazine, March 1988, pp. 6-17.

Johnson, Allen ed., "John A. Brashear," Dictionary of American Biography, New York: Charles Scribner's Sons, Inc., 1943. II: 605-606.

Kirby-Smith, H.T. U.S. Observatories: A Directory and Travel Guide. New York: Van Nostrand Reinhold Company, 1976.

Osterbrock, Donald E. James E. Keeler: Pioneer American Astrophysicist. Cambridge, England: Cambridge University Press, 1984.

Sinnott, Roger W. "The Wandering Stars of Allegheny," Sky and Telescope, October 1987, pp. 360-363.

Stephens, Carlene E. Inventing Standard Time. Washington, DC: Smithsonian Institution, 1983.

The Allegheny Observatory of the University of Pittsburgh. Pittsburgh, Pennsylvania, University of Pittsburgh, no date. (Brochure)

Withey, Henry F., and Elsie Rathburn Withey. Biographical Dictionary of American Architects (Deceased). Los Angeles, California: Hennessey & Ingalls, Inc., p. 59.

Wolkowicz, Richard. "Alien Worlds: The Search Heats Up," Discover Magazine, October 1987, pp. 66-77.

Zacher, Susan M. "National Register of Historic Places Inventory-Nomination Form--Allegheny Observatory." Harrisburg, Pennsylvania: Pennsylvania Historical and Museum Commission, 1979.

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National Park Service**

**National Register of Historic Places
Continuation Sheet**

Section number 10 Page 2

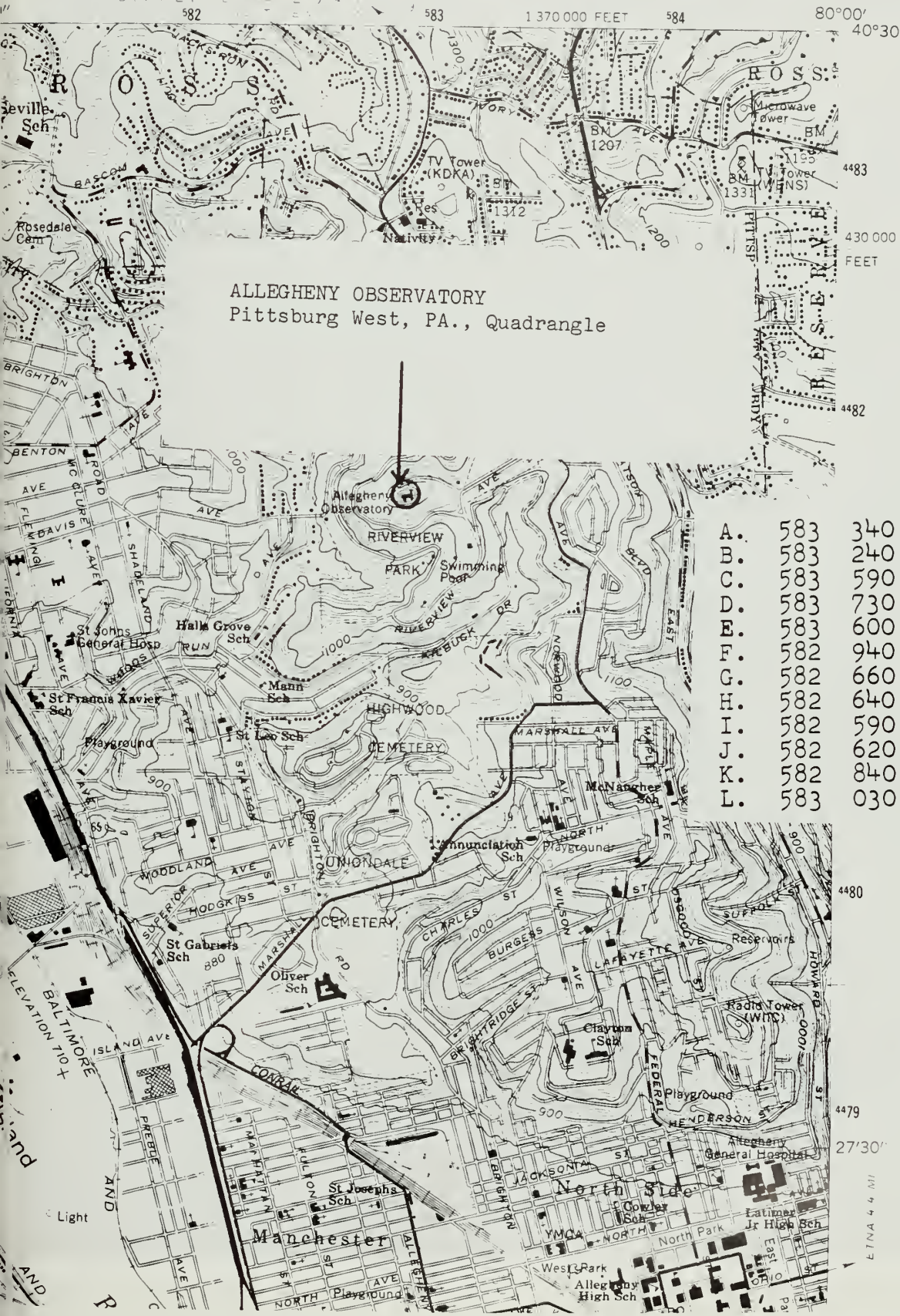
Starting at a point on the north side of Riverview Avenue, moving northeast for 1250 feet then west for 250 feet then north for 250 feet then west for 375 feet then northwest for 500 feet then west for 635 feet to street then along east side of street for 2375 feet then southeast for 1375 feet then west for 500 feet then south for 1000 feet then east for 750 feet then north for 125 feet then east for 130 feet then south for 255 feet then east for 1025 feet then east for 1625 feet to west side of Perrysville Avenue then north for 250 feet then east for 200 feet then north for 100 feet then east for 125 feet then north for 200 feet then east for 300 feet to west side of Perrysville Road then along west side of road for 750 feet then southwest for 200 feet then northeast for 250 feet then northeast for 310 feet to west side of Perrysville Road then along west side of road for 2050 feet then west for 1250 feet then north for 250 feet to starting point.

Pittsburg West Quadrangle:

- A. 583 340 4481 960
- B. 583 240 4481 560
- C. 583 590 4481 760
- D. 583 730 4481 260
- E. 583 600 4481 020
- F. 582 940 4480 880
- G. 582 660 4480 900
- H. 582 640 4481 220
- I. 582 590 4481 600
- J. 582 620 4481 860
- K. 582 840 4482 110
- L. 583 030 4482 140

PITTSBURGH WEST QUADRANGLE
 PENNSYLVANIA—ALLEGHENY CO.
 7.5 MINUTE SERIES (TOPOGRAPHIC)

5065 III SW
 (GLENDAW)



ALLEGHENY OBSERVATORY
 Pittsburg West, PA., Quadrangle

A.	583	340	4481	960
B.	583	240	4481	560
C.	583	590	4481	760
D.	583	730	4481	260
E.	583	600	4481	020
F.	582	940	4480	880
G.	582	660	4480	900
H.	582	640	4481	220
I.	582	590	4481	600
J.	582	620	4481	860
K.	582	840	4482	110
L.	583	030	4482	140



Allegheny Observatory — Pittsburgh, Pennsylvania
Front View of the Allegheny Observatory, 1988

Photo Credit: Allegheny Observatory



Allegheny Observatory — Pittsburgh, Pennsylvania
John Brashear Statue, 1988

Photo Credit: Allegheny Observatory



Allegheny Observatory — Pittsburgh, Pennsylvania
Lecture Hall with historic telescopes, 1988

Photo Credit: Allegheny Observatory



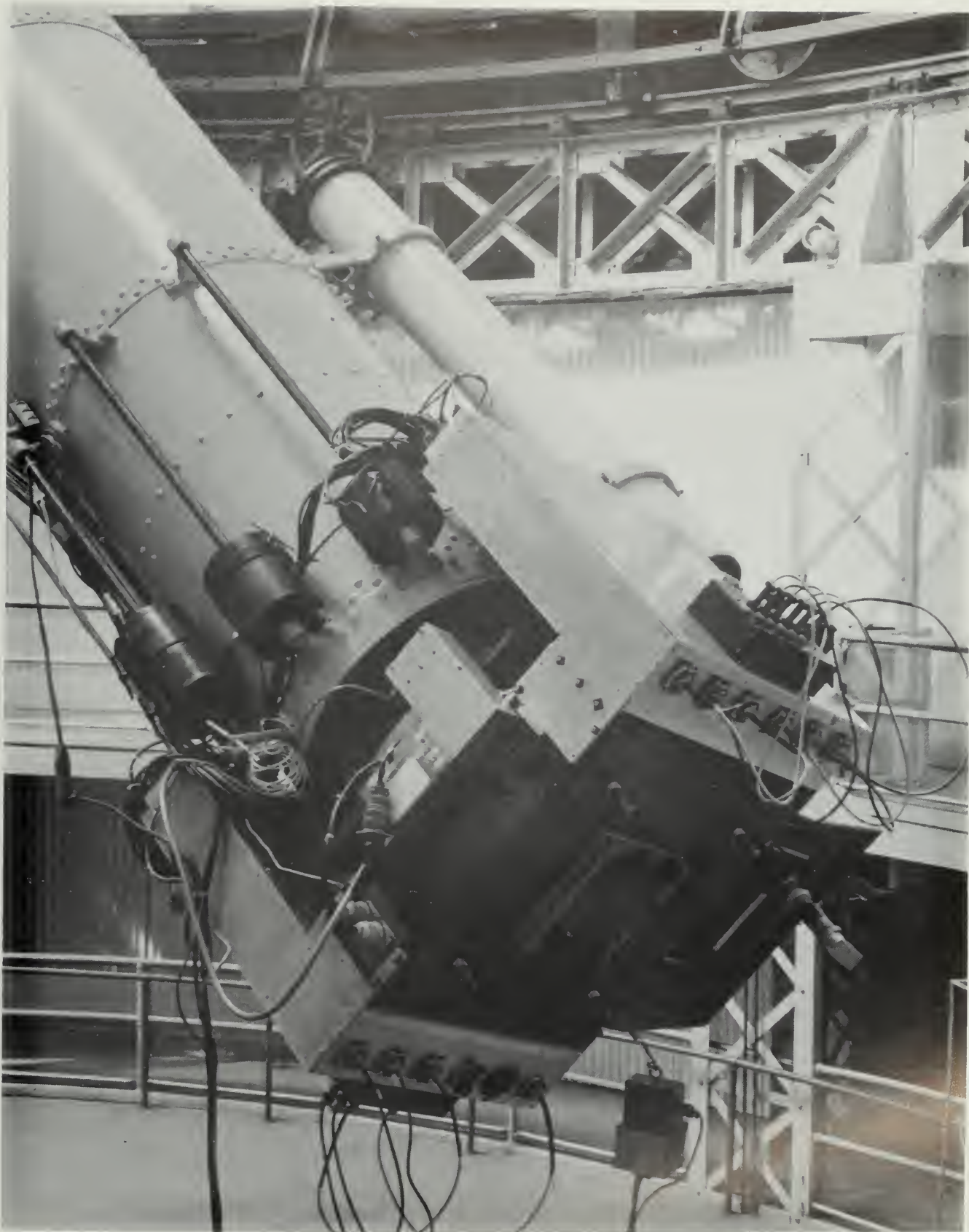
Allegheny Observatory — Pittsburgh, Pennsylvania
Library, 1988

Photo Credit: Allegheny Observatory



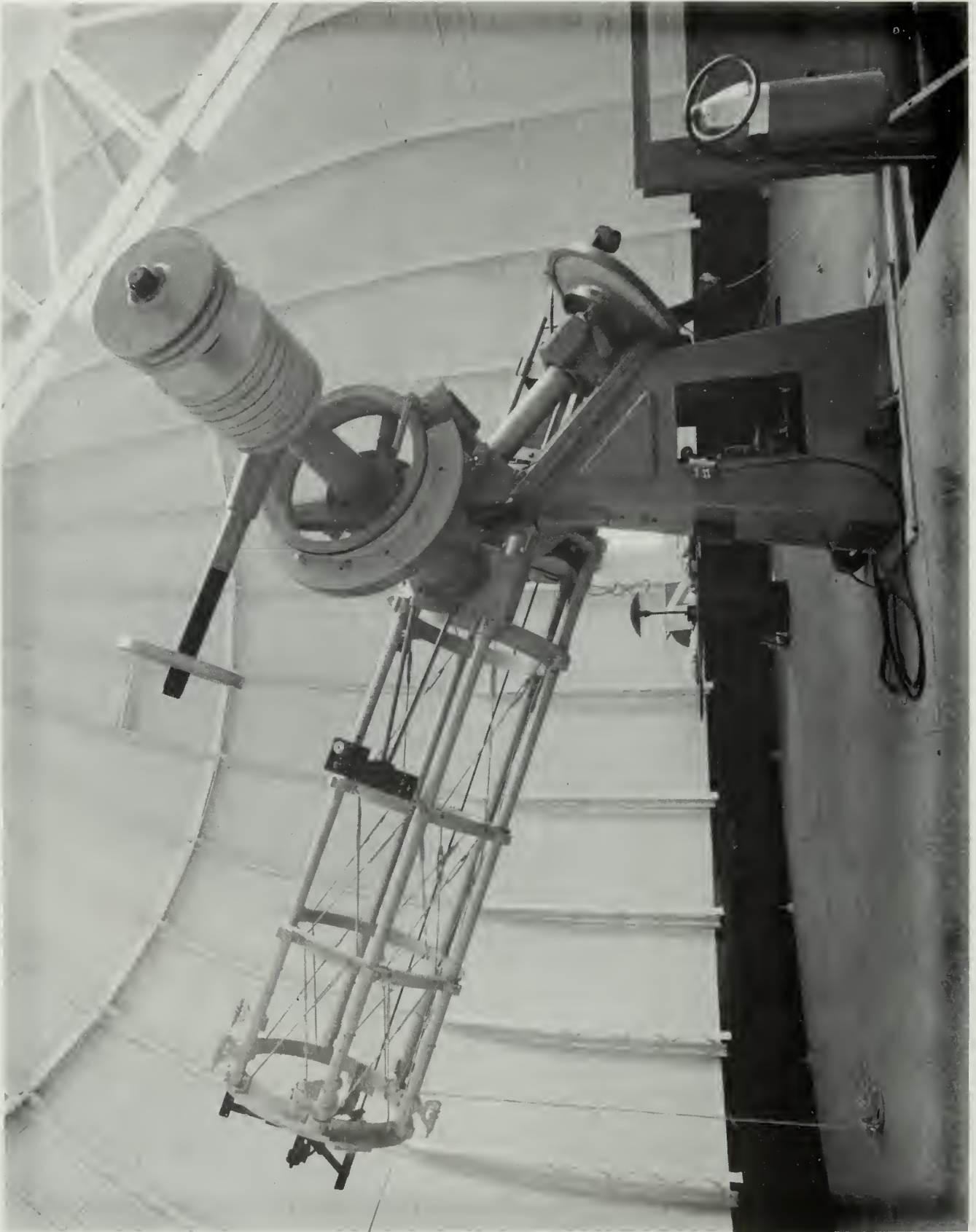
Allegheny Observatory — Pittsburgh, Pennsylvania
30-inch Thaw Refractor, 1983

Photo Credit: Allegheny Observatory



Allegheny Observatory — Pittsburgh, Pennsylvania
Multichannel Astrometric Photometer (MAP) on the Thaw Telescope, 1988

Photo Credit: Allegheny Observatory



Allegheny Observatory — Pittsburgh, Pennsylvania
31-inch Keeler Reflecting Telescope, 1988

Photo Credit: Allegheny Observatory



Allegheny Observatory — Pittsburgh, Pennsylvania
31-inch Fitz-Clark Reflector, 1988

Photo Credit: Allegheny Observatory



Allegheny Observatory — Pittsburgh, Pennsylvania
Plate Collection (112,000 to date), 1988

Photo Credit: Allegheny Observatory

PHOEBE · S · BRASHEAR
1843 - 1910

WE MAY LEARN THE BOARD'S HISTORY
TO BE IT ANIMAL OPTIC NIGHT

JOHN · A · BRASHEAR
1840 - 1920

Allegheny Observatory — Pittsburgh, Pennsylvania
Crypt, 1938

Photo Credit: Allegheny Observatory

JAMES EDWARD KEELER
1857 — 1900

HENRY BOWMAN KEELER
1893 — 1918

Allegheny Observatory — Pittsburgh, Pennsylvania
Crypt, 1988

Photo Credit: Allegheny Observatory

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National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See Instructions in Guidelines for Completing National Register Forms (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name Stellafane Observatory other names/site number

2. Location

street & number Off Breezy Road not for publication city, town Springfield vicinity state Vermont code VT county Windsor code 027 zip code 05413

3. Classification

Table with 3 columns: Ownership of Property, Category of Property, and Number of Resources within Property. Includes checkboxes for private/public ownership and building/site/structure/object categories. Includes counts for contributing and noncontributing resources.

Name of related multiple property listing: Number of contributing resources previously listed in the National Register 2

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property meets does not meet the National Register criteria. See continuation sheet. Signature of certifying official Date State or Federal agency and bureau

In my opinion, the property meets does not meet the National Register criteria. See continuation sheet. Signature of commenting or other official Date State or Federal agency and bureau

5. National Park Service Certification

hereby, certify that this property is: entered in the National Register. determined eligible for the National Register. determined not eligible for the National Register. removed from the National Register. other, (explain:)

Signature of the Keeper Date of Action

6. Function or Use

Historic Functions (enter categories from instructions)

Social, Education

Current Functions (enter categories from instructions)

Social, Education

7. Description

Architectural Classification

(enter categories from instructions)

Vernacular

Materials (enter categories from instructions)

foundation rubblestone

walls wood, shingles

woodframe, woodshingles

roof concrete

other

Describe present and historic physical appearance.

The Stellafane Observatory stands at an elevation of 1270 feet on an exposed shoulder of a hill one-quarter mile southeast of the Breezy Hill Road in Springfield, Vermont. The observatory complex consists of two buildings designed by Russell W. Porter: the clubhouse of the Springfield Telescope Makers, Inc., and the observatory proper containing a 12-inch reflecting turret telescope also designed by Porter. Both the clubhouse and the observatory remain essentially in original condition. The clubhouse occupies the crest of a rocky knoll in an opening of 2.5 acres; the smaller observatory stands about 60 feet to the north at a slightly lower elevation. Oriented toward the north, the buildings face the dominant feature of Mount Ascutney (3150 feet elevation) on the visible horizon.

The clubhouse of the Springfield Telescope Makers consists of a 1-1/2-story, wood frame building set on a rubblestone foundation. The original main section of the building was erected in 1924 on a rectangular plan of 20 x 24 feet; a one-story, 11 x 13-foot ell was added to its southwest corner in 1926. The entire building is sheathed with tongue-and-groove wood siding hung vertically. The gable roofs over both sections are covered with asphalt shingles and show exposed rafter tails at the eaves.

The main (north) facade of the clubhouse displays considerable ornamentation in contrast to the simplicity of the rest of the building. The central main entrance is flanked by two wood Doric columns which support a full entablature. The columns, in turn, are flanked by paired hooded windows. The gable end is distinguished by exposed vertical ribs and by wide bargeboards which are incised with the phrase, "The Heavens Declare The Glory of God." A wood flag mast rises from the doorway entablature upward through the gable peak. A small metal trade sign depicting a man with a telescope and the inscription "Stellafane" hangs over the doorway.

At the southeast corner of the clubhouse, a secondary entrance opens onto a small recessed porch. The slightly flared extension of the roof over the porch is carried by two rough peeled log columns; a simple balustrade connects the columns. On the south wall of the building, between a hooded double window

 See continuation sheet

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and the corner of the entrance porch, a large sundial is painted onto the sheathing in contrasting colors.

The observatory building, constructed on an outcrop of bedrock in 1930-31, consists of a one-story, 8 x 10-foot wood frame section attached at its north end to a circular reinforced concrete structure supporting the telescope. The wood frame section is sheathed with flush boards hung vertically; its gable roof is covered with wood shingles. The concrete structure has a diameter of 7.5 feet and is capped with a reinforced concrete dome, or turret, mounted at an oblique angle on a steel equatorial ring. From one side of the rotating turret, a 17-foot truncated pyramidal boom constructed of steel pipe and rod extends outward to support the parabolic mirror. On the opposite side of the turret, a single steel pipe extends outward to serve as a counterweight to the boom.

The telescope operates in the following manner: light from a celestial body strikes a 12-inch circular glass flat mirror mounted on the exterior of the turret from which it passes to the parabolic mirror mounted at the outer end of the boom. The mirror reflects the light back through a central hole in the flat mirror to the focal point at the eyepiece of the telescope inside the turret. This design enables the observer to remain inside a sheltered space which can be heated for comfortable observation during cold winter nights without distorting the optical performance of the glass flat and parabolic mirror.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

nationally statewide locally

Applicable National Register Criteria A B C D NHL Criteria 1,2

Criteria Considerations (Exceptions) A B C D E F G

Areas of Significance (enter categories from instructions)

National Register Significance
Education, Invention, Science

Period of Significance

1924

Significant Date

National Historic Landmark,
Science, Subtheme: Physical Science,
Facet: Astronomy Theme: Technology,
Subtheme: Tools and Machine

Cultural Affiliation

Significant Person

Russell W. Porter

Architect/Builder

Russell W. Porter

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

Summary

The Stellafane Observatory in Springfield, Vermont is significant for its pioneering role in the development of amateur telescope making and popular astronomy in the United States. The Stellafane complex contains both the original clubhouse of the first organized group of amateur telescope makers in the country, the Springfield Telescope Makers, Inc., and the first large optical telescope built and owned by that kind of amateur society. Since their construction in 1924 and 1930, respectively, the clubhouse and observatory have remained in continuous use by the Springfield Telescope Makers, and have been preserved essentially in original condition. Stellafane now holds an international reputation which attracts thousands of amateur telescope makers and astronomers to annual conventions held on the site.

History

The origin of the Stellafane Observatory derives from the efforts of one person, Russell W. Porter (1871-1949), an arctic explorer, artist, astronomer, architect, and engineer. Porter aroused the initial interest in telescope making and then taught the techniques of that subject to a group mostly of skilled craftsmen who worked for the machine tool industry in Springfield. Subsequently, Porter designed for the group both the clubhouse and observatory at Stellafane. From 1920 to 1928 Porter provided intellectual stimulus and practical leadership to the group until he left for California to work on the giant Palomar telescope. Owing to his pioneering work at Springfield, Porter is now respected internationally as the founder of the amateur telescope-making movement.

The first meeting of the amateur telescope makers occurred in August 1920 at the Jones and Lamson Machine Company in Springfield. Instructed and inspired by Russell Porter, 16 people began the highly precise and challenging task of building their own telescopes. During succeeding months, Porter expanded the activity of the group to astronomical observation, taking field trips to local hilltops for all-night sessions.

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During the fall of 1923 the group undertook construction of the building on Breezy Hill which became its clubhouse; Porter contributed the plot of land, the architectural design, and the cost of some building materials. In December of the same year, the group established itself formally as the Springfield Telescope Makers, Inc., and elected Porter president. The basic requirement for membership consisted of making one's own mirror suitable for mounting in a telescope. At a meeting in January 1924 Porter suggested the name "Stellar Fane"--meaning "shrine to the stars"--for the new clubhouse; it was adopted but soon shortened to Stellafane. Here the members brought their telescopes for evenings of lectures and discussions on telescope making and astronomy followed by nights of observing.

Interest in the activities of the telescope makers soon began to spread beyond Springfield. The first articles about Stellafane appeared in national magazines later in 1924. Then in June 1925 Albert G. Ingalls, an editor of Scientific American, visited the site to gather information for an article which appeared in the November 1925 issue. That article generated enthusiastic response throughout the United States and around the world. Other articles about Stellafane and telescope making by Ingalls and Porter followed in the same journal and brought an ever-increasing response. Soon John M. Pierce, the vice-president of the club, began to ship instructions and materials for making telescopes to meet requests from all over the world.

In July 1926 the tradition of the summer convention of amateur telescope makers at Stellafane was inaugurated with the first gathering of twenty persons, mostly from New England and New York. The following summer, three times that number came to the second Stellafane convention. Meanwhile, Ingalls had edited a new book on telescope making, including articles by Porter; the first printing was sold out by 1928. In May of that year, Ingalls started a regular column in Scientific American devoted to telescope making.

The popular movement in telescoping and astronomy was expanding rapidly from the nucleus at Springfield into an international phenomenon.

The relationship between Porter and the Springfield Telescope Makers changed abruptly late in 1928 when Porter moved to California to join the work then beginning on the 200-inch Palomar telescope, the largest in the world. Nevertheless he continued to communicate frequently with, and assist, the Springfield group and he returned for the annual conventions. Indeed, perhaps his greatest single contribution to the Springfield group was still to come: in the fall of 1929 Porter presented to the group his plans for a large telescope for the Stellafane site --"the first reflecting turret telescope in

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the world." Porter returned to Springfield the following summer to direct construction of the observatory, which was finally completed in 1931. The resulting Porter Turret Telescope at Stellafane and a smaller turret telescope with refractive optics also in Springfield are, according to Alan B. Rohwer, a former President of the Springfield Telescope Makers, the "only two turret-type telescopes known currently to exist."

Porter attended the summer convention at Stellafane for the last time in 1946; he died in California three years later. Since then, the membership of the Springfield Telescope Makers has expanded into other states, and the activity at Stellafane continues to flourish, especially at the annual conventions. Nearly 3000 people from throughout the United States, Canada, and many other countries now gather at Stellafane every summer to share ideas and experiences in a strictly non-commercial milieu, to display their increasingly sophisticated telescopes, for judging of mechanical design and operation under the dark Vermont sky. Among amateur telescope makers and astronomers Stellafane is now considered a shrine to Russell W. Porter and the founding of their movement: a trip to Stellafane is considered a pilgrimage.

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National Park Service

National Register of Historic Places Continuation Sheet

Section number 8 Page 4

Footnotes

1. The material for this nomination was taken primarily from the following source.

Hugh H. Henry, "National Register of Historic Places Inventory-Nomination form--Stellafane Observatory." (Montpelier, Vermont: Vermont Division for Historic Preservation, 1977).

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National Park Service

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Continuation Sheet

Section number 9 Page 2

Bibliography

Henry, Hugh H. "National Register of Historic Places-Nomination Form--
Stellafane Observatory." Montpelier, Vermont: Vermont Division of Historic
Preservation, 1977.

Marshall, Oscar Seth. journeyman machinist: en route to the stars: Stellafane
to Palomar. Taunton, Massachusetts: W. S. Sullwold Publishing, Inc., 1979.

Sinnott, Roger W. "Stellafane: A First Visit," Sky and Telescope, November 1986
pp. 527-529.

Willard, Berton C. Russell W. Porter: Arctic Explorer, Artist, Telescope Maker.
Freeport, Maine: The Bond Wheelwright Company, 1976.

9. Major Bibliographical References

See Continuation Sheet

Previous documentation on file (NPS):

- preliminary determination of individual listing (36 CFR 67) has been requested
- previously listed in the National Register
- previously determined eligible by the National Register
- designated a National Historic Landmark
- recorded by Historic American Buildings Survey # _____
- recorded by Historic American Engineering Record # _____

See continuation sheet

Primary location of additional data:

- State historic preservation office
- Other State agency
- Federal agency
- Local government
- University
- Other

Specify repository: _____

10. Geographical Data

Acreage of property 2.5

UTM References

A 18 701290 4794460
 Zone Easting Northing

B
 Zone Easting Northing

C

D

See continuation sheet

Verbal Boundary Description: Beginning at a bolt in the ledge 100 ft. Easterly of the center of the building known as "Stellafane" and now used and occupied by grantees; thence north 16° east 166 ft. to a bolt in the ledge; thence north 74° west 200 ft. to a bolt in the ledge; thence south 16° east 134 ft. to the point of beginning. Meaning and intending to convey a rectangular plot of land 200 by 300 ft.

See continuation sheet

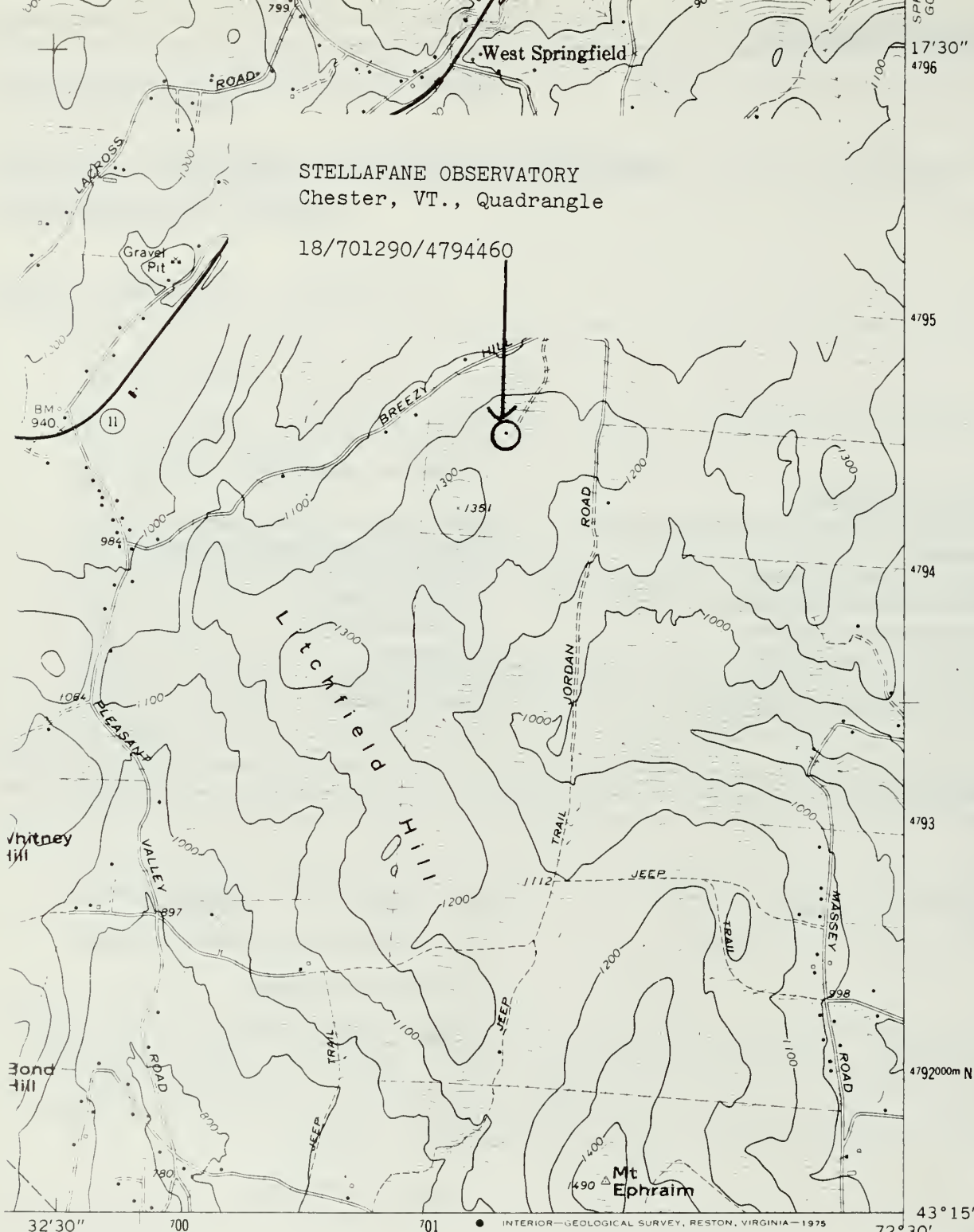
Boundary Justification

This is the legal boundary for the Stellafane Observatory.

See continuation sheet

11. Form Prepared By

name/title Harry Butowsky
 organization National Park Service date May 1, 1989
 street & number 1100 L Street, N.W. telephone (202) 343-8155
 city or town Washington state DC zip code 20013



STELLAFANE OBSERVATORY
Chester, VT., Quadrangle

18/701290/4794460

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1975
702000m E

ROAD CLASSIFICATION

- Primary highway, hard surface
- Secondary highway, hard surface
- Light-duty road, hard or improved surface
- Unimproved road
- Interstate Route
- U. S. Route
- State Route

6570 III
1:62,500
(BELLOW FALLS)

1 MILE



CHESTER, VT.
SE/4 LUDLOW 15' QUADRANGLE
N4315—W7230/7.5

1972

AMS 6470 I SE—SERIES V813

GLASS IN TELESCOPE MAKING.

ANY INTERESTED SEE
MR RUSSELL PORTER, OR
MR RAY BEARDSLEY, OR
MR JOHN PIERCE.





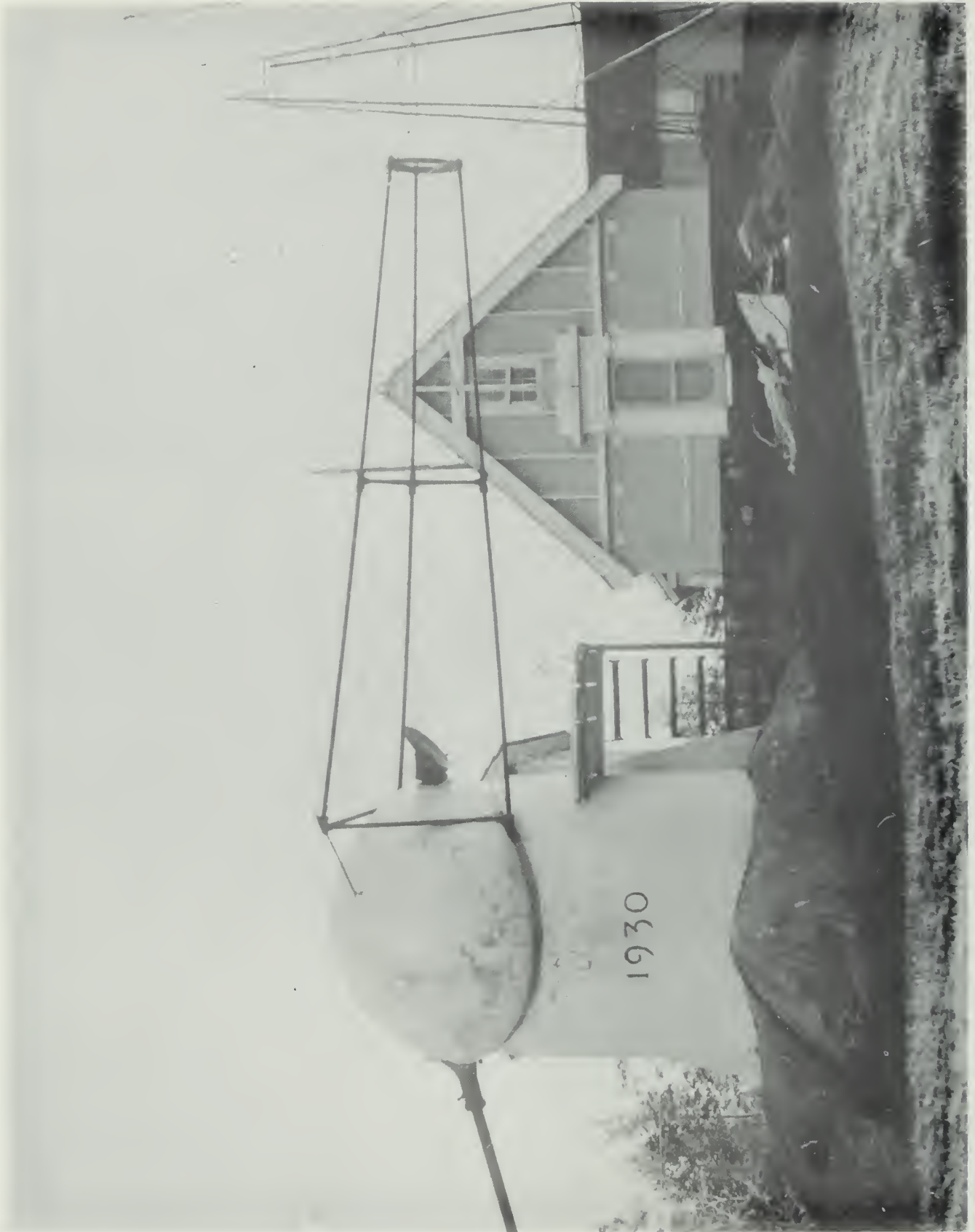
Stellafane Observatory — Springfield, Vermont
Front View of Clubhouse, 1988

Photo Credit: Stellafane Observatory



Stellafane Observatory — Springfield, Vermont
Trade Sign on the Clubhouse, 1988

Photo Credit: Stellafane Observatory



Stellafane Observatory — Springfield, Vermont
Front View of Clubhouse and Turret Telescope, 1983

Photo Credit: Stellafane Observatory



Stellafane Observatory — Springfield, Vermont
Turret Telescope, 1988

Photo Credit: Stellafane Observatory



Stellafane Observatory — Springfield, Vermont
Rear View of Turret Telescope, 1988

Photo Credit: Stellafane Observatory

ASTEROID
3140 STELLAFANE

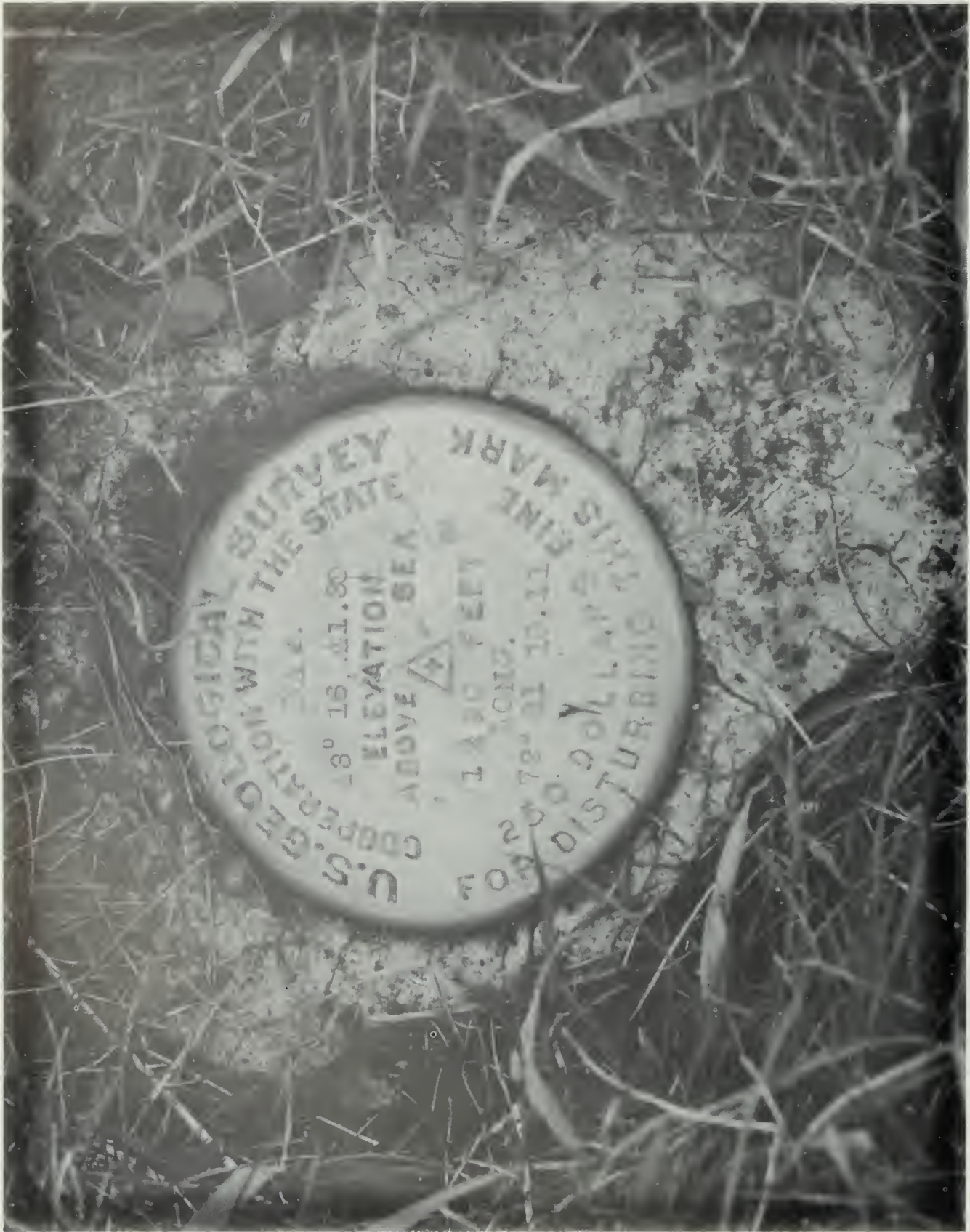
NAMED IN HONOR OF THE ANNUAL VERMONT
MEETING OF AMATEUR TELESCOPE MAKERS
WHERE ASTRONOMICAL IDEAS ARE EXCHANGED,
IMPROVED PERFORMANCE OF ASTRONOMICAL
INSTRUMENTS IS DEVELOPED, AND GOOD CONTACT
BETWEEN AMATEUR AND PROFESSIONAL
ASTRONOMERS IS FOSTERED

Asteroid Discovered
And Donated By Brian Skiff
Asteroid Name And Citation
Provided By Phil Dombrowski

AUGUST, 1988

Stellafane Observatory — Springfield, Vermont
Plaque located in the Clubhouse, 1988

Photo Credit: Stellafane Observatory



Stellafane Observatory — Springfield, Vermont
U.S.G.S. Survey Marker, 1983

Photo Credit: Stellafane Observatory

United States Department of the Interior
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National Register of Historic Places Registration Form

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1. Name of Property

historic name Reber Radio Telescope

other names/site number _____

2. Location

street & number National Radio Astronomy Observatory

not for publication

city, town Green Bank

vicinity

state West Virginia code WV

county Pocahontas

code 075

zip code 24944

3. Classification

Ownership of Property

- private
- public-local
- public-State
- public-Federal

Category of Property

- building(s)
- district
- site
- structure
- object

Number of Resources within Property

Contributing	Noncontributing
_____	_____ buildings
_____	_____ sites
<u>1</u>	_____ structures
_____	_____ objects
<u>1</u>	_____ Total

Name of related multiple property listing: _____

Number of contributing resources previously listed in the National Register 1

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of certifying official _____

Date _____

State or Federal agency and bureau _____

In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of commenting or other official _____

Date _____

State or Federal agency and bureau _____

5. National Park Service Certification

I, hereby, certify that this property is:

entered in the National Register.

See continuation sheet.

determined eligible for the National Register. See continuation sheet.

determined not eligible for the National Register.

removed from the National Register.

other, (explain:) _____

Signature of the Keeper _____

Date of Action _____

6. Function or Use

Historic Functions (enter categories from instructions)

Research Facility

Current Functions (enter categories from instructions)

Research Facility

7. Description

Architectural Classification
(enter categories from instructions)

N/A

Materials (enter categories from instructions)

foundation concrete

walls N/A

roof N/A

other iron, wood, steel

Describe present and historic physical appearance.

The Reber Radio Telescope was designed and built by Grote Reber in 1937 for his personal use in conducting research in the newly emerging field of radio astronomy. The original location of the telescope was in the backyard of his house at 212 West Seminary Road, in Wheaton, Illinois. Grote Reber's house is no longer extant. The entire block of 200 West Seminary Road, in Wheaton, Illinois, was demolished during the 1950s to construct a public park.

The telescope was originally a 31 foot 5-inch transit-mounted parabolic radio telescope reflector made from 72 wooden radial rafters, covered with skin of 26 gauge point iron (focal length: 20 feet), and 2 elevated arches positioned on railroad wheels to permit changes in elevation angles. The telescope took about 4 months to build and weighed about 2 tons when completed.

Reber used the telescope from 1937 to 1948 when he sold it to the National Bureau of Standards which moved it to an observing site in Sterling, Virginia. After the telescope was moved to Sterling, the National Bureau of Standards mounted the entire instrument on a turntable thus changing the original transit design to an altazimuth design.

In 1952 the telescope was disassembled and shipped to another observing site in Boulder, Colorado. Finally, in 1957, it was acquired by the National Radio Astronomy Observatory, in Green Bank, West Virginia, where in 1959-60 it was reassembled under Grote Reber's personal supervision. Some wooden parts were found deteriorated and replaced during this process. The telescope now stands on its 1948 turntable to the left of the entrance road of the National Radio Astronomy Observatory, in Green Bank, West Virginia, in proximity to the Karl Guthe Jansky Replica Antenna and the Ewen-Purcell Antenna.

With the exception of the change of mounting from the transit design to the altazimuth design and the replacement of some deteriorated wooden support members, the telescope retains its integrity from the period of its first use by Grote Reber in 1937-48. The telescope is in good condition and can be used for radio astronomy if needed.

In 1972 the telescope was listed on the National Register of Historic Places by the Antiquities Commission of the State of West Virginia.¹

See continuation sheet

3. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

nationally statewide locally

Applicable National Register Criteria A B C D NHL Criteria 1,2,4

Criteria Considerations (Exceptions) A B C D E F G

Areas of Significance (enter categories from instructions)

National Register: Invention, Science

National Historic Landmark: Science,

Subtheme: Physical Science: Facet,

Astronomy

Period of Significance

1937-1948

Significant Dates

Cultural Affiliation

N/A

Significant Person

Grote Reber

Architect/Builder

Grote Reber

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

Summary

The Reber Radio Telescope was the first parabolic antenna specifically designed and built to do research in the newly emerging field of radio astronomy. The telescope was designed and built by Grote Reber, an amateur astronomer and electronics expert from Wheaton, Illinois, who from 1937 until after World War II, was the world's only active radio astronomer. The telescope design is the forerunner of the majority of present day radio telescopes.

History

Until the 20th century, astronomers were limited to what they could see or photograph in the visible spectrum of light--a relatively narrow band of wavelengths. This all changed in 1932, when Karl Jansky, a radio engineer at Bell Laboratories in Holmdel, New Jersey, was the first to establish that radiation at radio wavelengths was reaching the earth from interstellar space.²

Jansky joined Bell Laboratories in Holmdel, New Jersey, in 1928 and began studying static and other noises affecting Bell System transoceanic radio-telephone circuits. In 1929 he designed and built a 14.6 meter-rotatable, directional antenna system to study radio noise. Two years later he was able to classify the noise into three types: that due to local thunderstorms; that due to distant thunderstorms; and a steady hiss of static, the origin of which was not known.

This unknown static fascinated Jansky because its source could not be traced to any location on the earth or in the solar system. He made an extensive study of the noise in 1932, finding that it varied not every 24 hours but every 23 hours and 56 minutes. This is the period of the earth's sidereal day, a day defined by the earth's rotation relative to the stars, not the sun. Therefore the source of the noise was outside of the solar system and fixed in space. After discussing this information with an astronomer, Jansky concluded that the static was coming from the center of our galaxy, the Milky Way.

See continuation sheet

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Continuation SheetSection number 8 Page 2

Jansky published his findings in scientific journals, and, on May 5, 1933, The New York Times carried his discovery on the front page. Jansky's discovery of the existence of interstellar radio waves with his antenna liberated astronomers from the confines of optical astronomy and opened up the radio portion of the electromagnetic spectrum for productive research. The longer radio waves could penetrate not only the earth's atmosphere, but also clouds of interstellar dust that previously had obscured large sections of space. When Jansky was not allowed to continue with basic research into the field of radio astronomy by Bell Laboratories, another pioneer, Grote Reber, continued his work.

Grote Reber read Jansky's papers and was one of the first scientists to appreciate the significance of Jansky's discovery. To quote his own words:

In my estimation it was obvious that Jansky had made a fundamental and very important discovery. Furthermore, he had exploited it to the limit of his equipment facilities. If greater progress were to be made it would be necessary to construct new and different equipment especially designed to measure the cosmic static. 3

Reber's decision to continue Jansky's work meant that he would have to design and build the world's first radio telescope. Since no one had ever done this before, Reber was on his own. After studying the problem, he decided to construct a large parabolic reflector with the intention of observing at a very short wavelength, about 10 cm. He realized that a parabolic reflector would have the advantage of providing a narrow symmetrical beam and would also enable the wavelength to be altered simply by changing the receptor at the focus. In the choice of operating wavelength Reber was guided by two considerations he could achieve better angular resolution and the radiation should be stronger at shorter wavelengths.

With these considerations in mind, Reber began to build the first radio telescope specifically designed for radio astronomical observations. Since he had no outside source of funding to build his telescope he had to do all of the work by hand in his own backyard. Reber originally preferred a full steerable mounting, but this was far too expensive, so he decided on a meridian transit instrument steerable in elevation only, relying on Earth's rotation to scan the heavens. While he wanted as large a reflector as possible, Reber had to balance the cost with his resources and finally decided on a sheet metal surface of 31-foot diameter, to be mounted on a wooden supporting structure for the sake of cheapness and ease of construction. The reflector surface consisted of 45 pieces of 26-gauge galvanized iron sheet screwed on 72 radial wooden rafters cut to parabolic shape. Reber cut, drilled and painted all of the parts. Except for the part-time assistance of two men on foundations and erections, Reber personally put together the radio telescope piece by piece, and completed the entire job in four months from June to September 1937. The final telescope cost Reber \$4,000.

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During the decade after 1937 Reber, using his telescope, worked practically alone in the field of radio astronomy. By 1940 he confirmed Jansky's conclusion that the Milky Way is a source of radio radiation, and in 1944 he published in the Astrophysical Journal the first contour maps of radio brightness of the Milky Way as it appears at a wavelength of 1.87 meters. He discovered discrete sources of radio emission in the galactic center, Cygnus, and Cassiopeia, as well as radio waves from the sun. From 1937 until after World War II Reber was the world's only active radio astronomer.

Reber's Radio Telescope stands today as a monument to Grote Reber, a pioneer in the field of radio astronomy. With the construction of his telescope, Reber demonstrated his persistence in overcoming technical difficulties and his determination to do pioneering work in the field of radio astronomy. Grote Reber's work from 1937 to 1948, using the radio telescope he personally designed and built, demonstrated the importance of Jansky's discovery, and forever changed the science of astronomy.

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Footnotes

1. The descriptive material for this section was taken from the following sources:

Wallace R. Oref, "National Register of Historic Places Inventory-Nomination Form--Reber Radio Telescope." (Green Bank, West Virginia: National Radio Astronomy Observatory, 1972).

Historical Radio Telescopes at the National Radio Astronomy Observatory in Green Bank, West Virginia (Green Bank, West Virginia: Associated Universities Inc., no date).

J.S. Hey, The Evolution of Radio Astronomy (New York: Neale Watson Academic Publications, Inc., 1973), pp. 8-15.

2. The material for the statement of significance was taken from the following sources:

George A. Abell, The Exploration of the Universe (4th ed.; New York: Saunders College Publishing, 1982), pp. 220-224.

Hey, op. cit.

John Kraus, "The First 50 Years of Radio Astronomy, Part 1: Karl Jansky and His Discovery of Radio Waves from Our Galaxy," Cosmic Search, Fall 1981, pp. 8-12.

Oref, op. cit.

3. Hey, op. cit., p. 9.

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Section number 9 Page 2

Bibliography

- Aaronson, Steve. "Radio Astronomy and the Big Bang," Bell Laboratories Record. January 1979, pp. 6-11.
- Abell, George O. Exploration of the Universe. 4th ed., Philadelphia: Saunders College Publishing, 1982.
- Asimov, Isaac. Asimov's Biographical Encyclopedia of Science and Technology. 2nd ed., New York: Doubleday & Company, Inc., 1982.
- Hey, J.S. The Evolution of Radio Astronomy. New York: Neale Watson Academic Publications, Inc., 1973.
- Historical Radio Telescopes at the National Radio Astronomy Observatory in Green Bank, West Virginia. Green Bank, West Virginia: Associated Universities, Inc., no date.
- Kellerman, K., and B. Sheets, ed., Serendipitous Discoveries In Radio Astronomy. Green Bank, West Virginia: National Radio Astronomy Observatory/Associated Universities, Inc., 1983.
- Kirby-Smith, H.T. U.S. Observatories: A Directory and Travel Guide. New York: Van Nostrand Reinhold Company, 1976.
- Kraus, John. "The First 50 Years of Radio Astronomy, Part 1: Karl Jansky and His Discovery of Radio Waves from Our Galaxy," Cosmic Search, Fall 1981, pp. 8-12.
- Lerner, Richard. Astronomy Through the Telescope. New York: Van Nostrand Reinhold Company, 1981.
- Oref, Wallace R. "National Register of Historic Places Inventory-Nomination Form--Reber Radio Telescope." Green Bank, West Virginia: National Radio Astronomy Observatory, 1972.
- Struve, Otto, and Zebergs, Velta. Astronomy of the 20th Century. New York: Macmillan Company, 1962.
- Ronan, John J. "An Oracle Comes of Age: The National Radio Astronomy Observatory," Ham Radio Horizons, May 1977, pp. 12-16.
- The National Radio Astronomy Observatory. Green Bank, West Virginia: National Radio Astronomy Observatory/Associated Universities, Inc., 1988. (Brochure)

9. Major Bibliographical References

SEE CONTINUATION SHEET

Previous documentation on file (NPS):

- preliminary determination of individual listing (36 CFR 67) has been requested
- previously listed in the National Register
- previously determined eligible by the National Register
- designated a National Historic Landmark
- recorded by Historic American Buildings Survey # _____
- recorded by Historic American Engineering Record # _____

See continuation sheet

Primary location of additional data:

- State historic preservation office
- Other State agency
- Federal agency
- Local government
- University
- Other

Specify repository: _____

10. Geographical Data

Acreeage of property less than 1 acre

UTM References

A

1	7
---	---

6	0	3	1	8	0
---	---	---	---	---	---

4	2	5	4	0	0	0
---	---	---	---	---	---	---

 Zone Easting Northing

C

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B

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--	--	--	--	--	--	--

 Zone Easting Northing

D

--	--

--	--	--	--	--	--

--	--	--	--	--	--	--

See continuation sheet

Verbal Boundary Description

The boundary follows the outside perimeter of the telescope turntable.

See continuation sheet

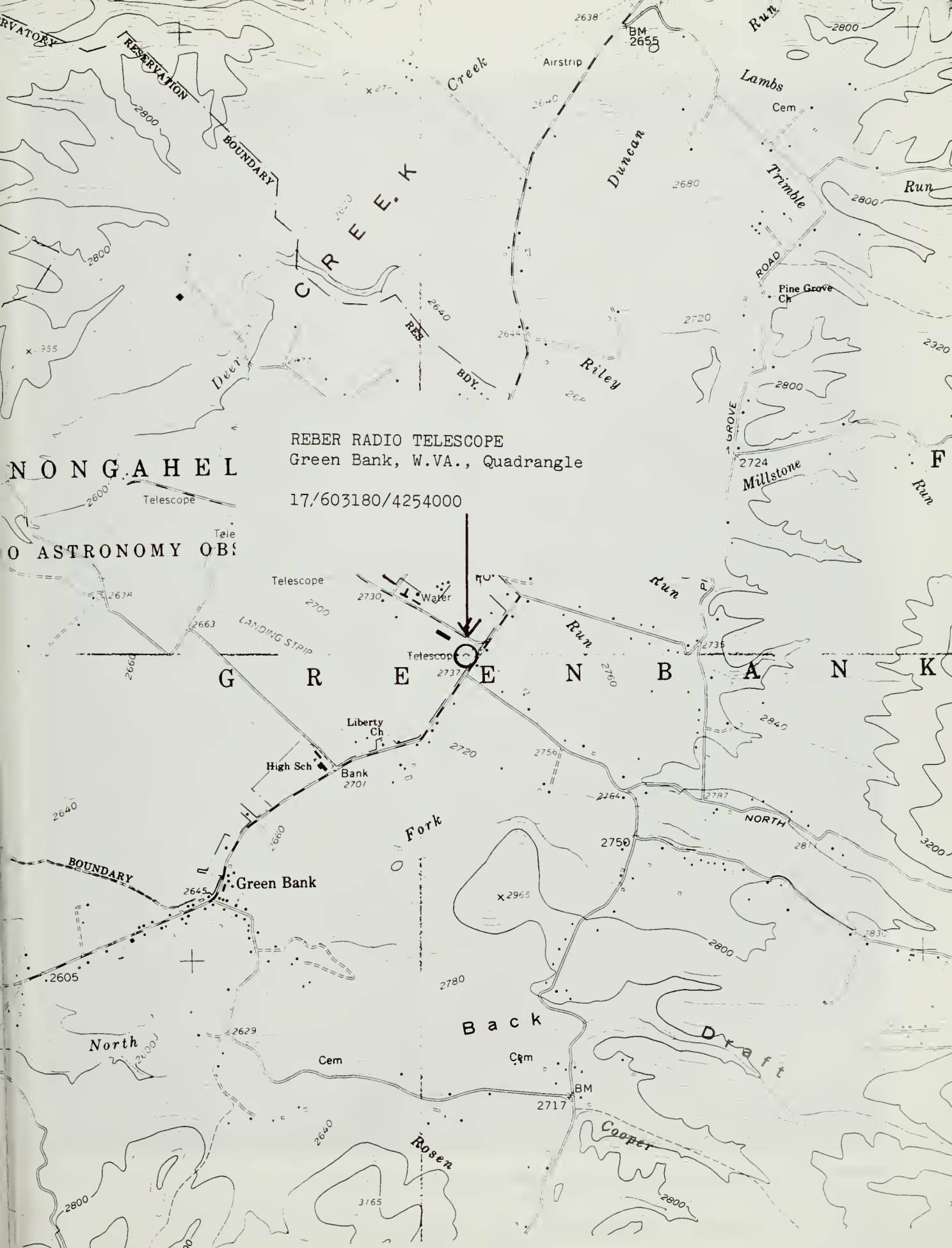
Boundary Justification

The boundary includes only the land upon which the telescope is sited, the sole historic resource.

See continuation sheet

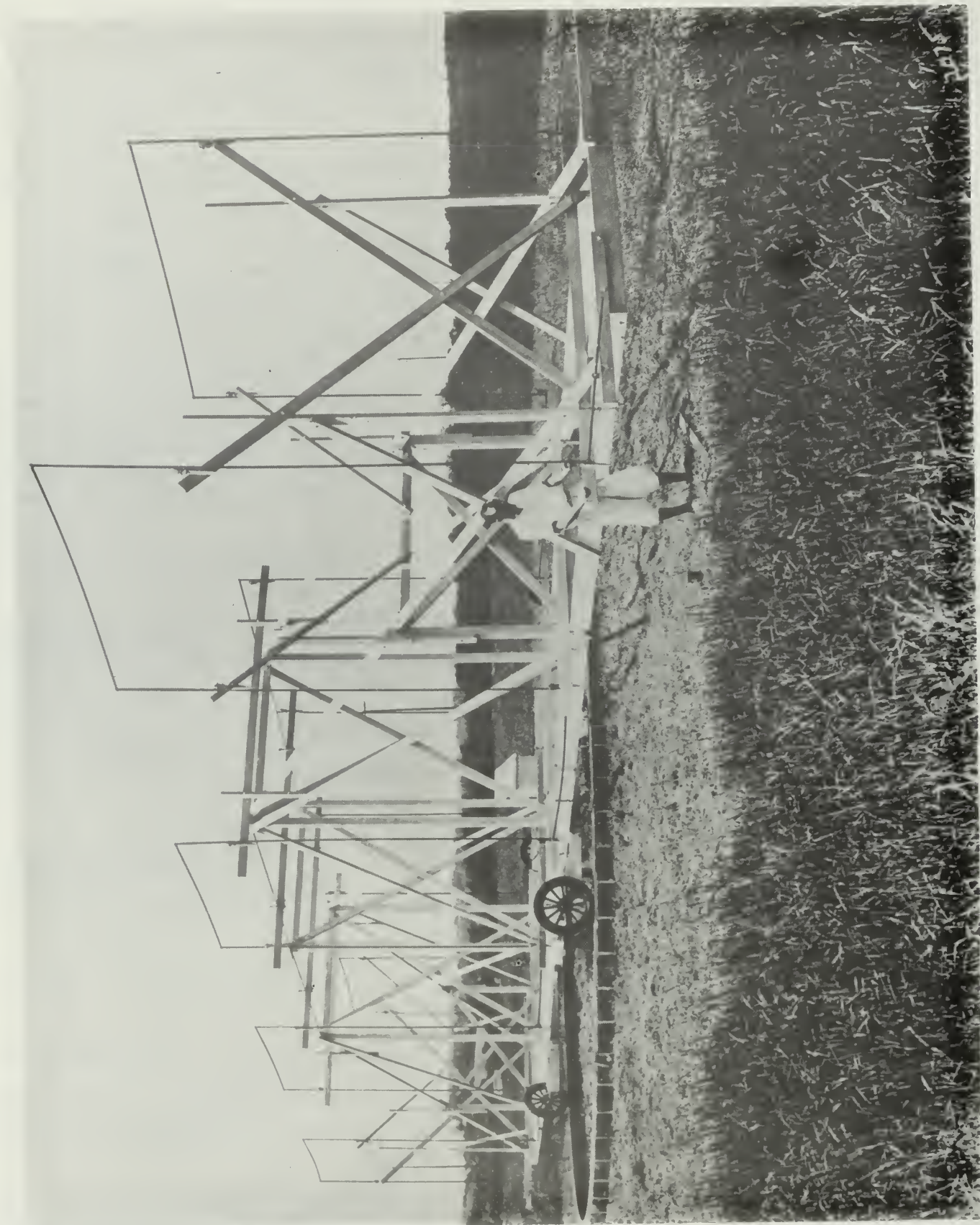
11. Form Prepared By

name/title Harry Butowsky date May 1, 1989
 organization National Park Service telephone (202) 343-8155
 street & number 1100 L Street, NW city or town Washington state DC zip code 20013



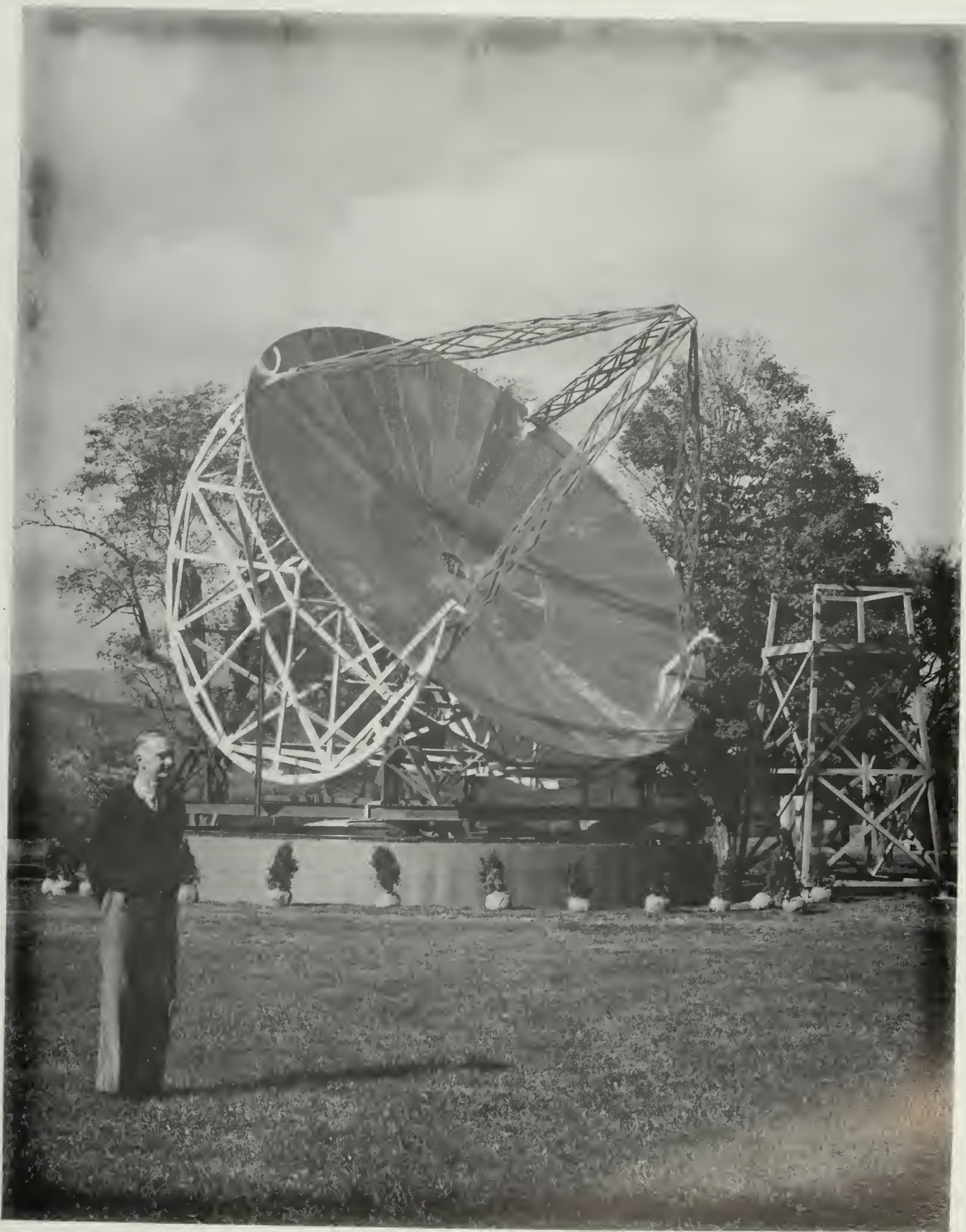
REBER RADIO TELESCOPE
Green Bank, W.VA., Quadrangle
17/603180/4254000

NONGAHEL
O ASTRONOMY OBS



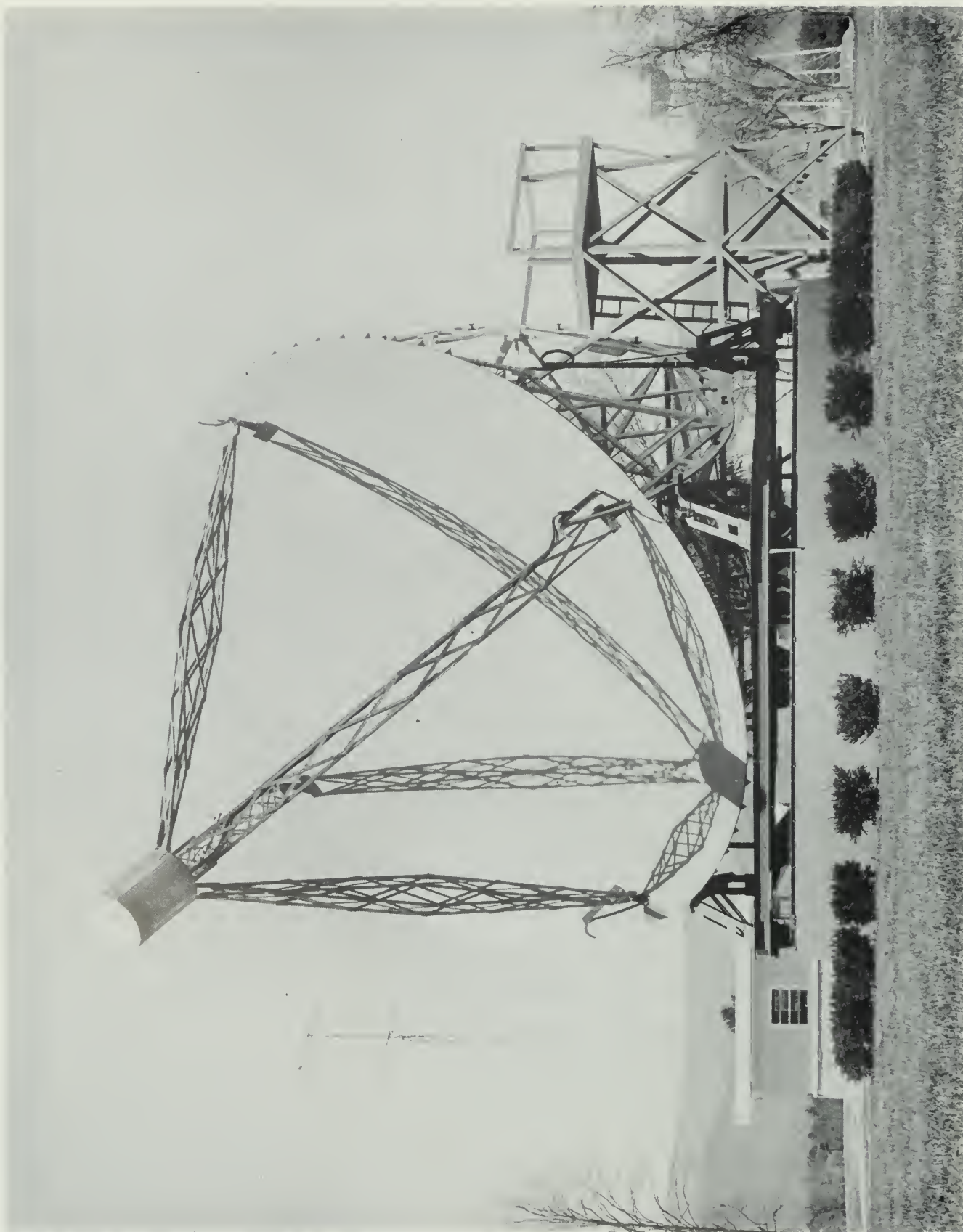
National Radio Astronomy Observatory — Green Bank, West Virginia
Karl Jansky and his Antenna in Holmdel, New Jersey, circa 1930

Photo Credit: National Radio Astronomy Observatory



National Radio Astronomy Observatory — Green Bank, West Virginia
Grote Reber standing in front of his Radio Telescope, circa 1960

Photo Credit: National Radio Astronomy Observatory



National Radio Astronomy Observatory — Green Bank, West Virginia
Reber Radio Telescope, 1962

Photo Credit: National Radio Astronomy Observatory

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name Yerkes Observatory
other names/site number _____

2. Location

street & number _____ not for publication
city, town Williams Bay vicinity
state Wisconsin code WI county Walworth code 127 zip code 53191-0258

3. Classification

Ownership of Property	Category of Property	Number of Resources within Property	
		Contributing	Noncontributing
<input checked="" type="checkbox"/> private	<input checked="" type="checkbox"/> building(s)	<u>1</u>	_____ buildings
<input type="checkbox"/> public-local	<input type="checkbox"/> district	_____	_____ sites
<input type="checkbox"/> public-State	<input type="checkbox"/> site	_____	_____ structures
<input type="checkbox"/> public-Federal	<input type="checkbox"/> structure	_____	_____ objects
	<input type="checkbox"/> object	<u>1</u>	_____ Total

Name of related multiple property listing: _____
Number of contributing resources previously listed in the National Register 0

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of certifying official _____ Date _____

State or Federal agency and bureau _____

In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of commenting or other official _____ Date _____

State or Federal agency and bureau _____

5. National Park Service Certification

I, hereby, certify that this property is:

entered in the National Register.
 See continuation sheet.

determined eligible for the National Register. See continuation sheet.

determined not eligible for the National Register.

removed from the National Register.

other, (explain:) _____

Signature of the Keeper _____ Date of Action _____

6. Function or Use

Historic Functions (enter categories from instructions)

Education

Research Facility

Current Functions (enter categories from instructions)

Education

Research Facility

7. Description

Architectural Classification

(enter categories from instructions)

Romanesque Revival

Materials (enter categories from instructions)

foundation concrete

walls brick, terra-cotta

roof stainless steel on large dome

other

Describe present and historic physical appearance.

Yerkes Observatory is the observing facility of the Department of Astronomy and Astrophysics of the University of Chicago and is devoted to research in astronomy and astrophysics, as well as graduate education. The observatory is on the west side of the village of Williams Bay, Wisconsin, on the bank of Lake Geneva, 76 miles from Chicago. Construction of the main observatory building began in 1895. The first astronomical observations were made in the summer of 1897. At the time of its construction, Yerkes Observatory was the most modern and complete observatory of its day.¹

The observatory was designed by Henry Ives Cobb from plans drawn by American astronomer George Ellery Hale, who had visited the large observatories of America and Europe and had gained useful information from the designs of the Lick Observatory in California and the Astrophysical Observatory at Potsdam, Germany. The style of the building is Romanesque with elaborate details. It is constructed of brown Roman brick with terra cotta ornaments to match. The shape is that of a Latin cross with the three towers and the meridian room at the extremities. The long axis lies east and west with the great dome to the west. The length of the building in this direction is 326 feet. The smaller domes are on the north-and-south axis, with their centers 144 feet apart.

The principal floor contains offices for the staff, a lecture room, a large reference library, and a reading room. The basement contains darkrooms, a photographic laboratory, a machine shop, and maintenance rooms. The second floor is used for stackrooms for library books, storage of archival materials, sleeping rooms for observers, and a large analysis room where an electronic computer is found. A glass copy of the National Geographic-Palomar Observatory Sky Survey is also stored and used on this floor. An environmentally controlled vault, for the storage and preservation of the observatory's irreplaceable collection of photographs taken over the years with the telescopes at Yerkes, occupies the east end of the main and second floors.

See continuation sheet

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Situated at the eastern end of the building are two small domes and a small meridian transit room. The northern dome originally contained George Ellery Hale's 12-inch refractor from his old Kerwood Observatory in Chicago. The southern dome contains a 24-inch reflector telescope. These telescopes have been replaced with newer, more modern telescopes. The northern dome now houses a modern 24-inch reflector; the southern dome houses a 41-inch reflector placed in operation in 1968. The meridian room, although intact, is no longer operational.

The great dome, housing the 40-inch refractor, is on the western end of the building. This telescope is the largest refractor ever completed, with a gain of 4 inches aperture and 23% in light-gathering ability over its nearest rival, the 36-inch refractor at Lick Observatory in California. The 40-inch glass lens for the refractor was cast by the firm of Mantois in Paris and ground by Alvan G. Clark, the great telescope maker from Cambridge, Massachusetts. The telescope tube, mounting, dome, and rising floor were designed by the firm of Warner & Swasey of Cleveland, Ohio.

The telescope is mounted on a massive brick pier which rests on a solid concrete foundation set in a gravel formation. The column is of cast iron in four heavy sections. The center of motion of the telescope is 61 feet above the ground; when the spectroscopic attachments are added, this is increased by nearly 6 feet.

The telescope is moved from one position to another by means of electric motors and is so finely balanced that it can be moved by hand. The entire telescope weighs 20 tons. For finer motions, such as required in spectroscopic and photographic work, additional motors, controlled from the position of the observer, are used. The telescope was modernized in 1969 permitting more accurate and rapid setting of the position of the telescope. The efficiency of the telescope was further increased by the addition of an automatically guiding camera. The driving clock, by which the telescope is made to follow the stars, consists of a synchronous motor controlled by an electronic oscillator, the frequency of which can be set so as to make the telescope follow the sun, the moon, or stars.

The dome covering the 40-inch refractor is 90 feet in diameter. It is turned on 26 wheels by an electric motor which actuates an endless wire rope extending around the dome. The original dome surface, made of wood covered by a thin sheet of metal, was replaced by stainless steel in 1975. The opening through which the sky is observed is 11 feet wide, and is closed by shutters 85 feet long. These are so constructed that

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National Park Service****National Register of Historic Places
Continuation Sheet**Section number 7 Page 3

they can be moved by hand, although they are usually operated by an electric motor. Canvas screens, which may be raised over part of the opening, serve to break the force of the wind. The rising floor is 75 feet in diameter and is supported by cables running over four sheaves just beneath the upper balcony and connecting heavy counterpoises which balance the weight of the floor (37-1/2 tons). The motors for moving the dome and the floor can be operated from the floor or the eye end of the telescope. The floor moves through a range of 23 feet from the lower to the upper balcony. It has to be near its lowest point when a star near the zenith is observed. In intermediate positions it can be quickly adjusted to any height from the eyepiece of the telescope.

Statement of Significance

certifying official has considered the significance of this property in relation to other properties:

nationally statewide locally

Applicable National Register Criteria A B C D NHL Criteria 1 and 3.

Criteria Considerations (Exceptions) A B C D E F G

Areas of Significance (enter categories from instructions)
National Register: Education, Engineering

Period of Significance
1897-Present

Significant Dates

National Historic Landmark: Science,
Subtheme: Physical Science, Facet:
Astronomy.

Cultural Affiliation

Significant Person
George Ellery Hale

Architect/Builder
Henry Ives Cobb

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

Summary

Yerkes Observatory was founded by American astronomer George Ellery Hale in 1897 and represents his revolutionary concept for an observatory that would also be a physical laboratory. To the majority of astronomers at the time, an observatory was simply a place for a telescope and observer. For example, when the new United States Naval Observatory in Washington, DC was completed in 1893 there was no provision for a darkroom or for a spectroscopic laboratory. In contrast, Yerkes Observatory was provided with laboratories and a variety of mechanical and electronic workshops. Yerkes represented the wave of the future and established the modern observatory as a research institution where the astronomer, using the disciplines of chemistry and physics, supported by engineering and optics workshops, could apply his talents to the understanding of the wonders of the universe. In the years since its founding by George Ellery Hale, Yerkes has attracted the most famous astronomers in the world, and contributed significantly to the sciences of astronomy and astrophysics.²

History

The establishment of Yerkes Observatory near the city of Chicago was the joint idea of astronomer George Ellery Hale and William Harper, president of the University of Chicago. George Ellery Hale, then a recent physics graduate from M.I.T., wanted a first-rate observatory where he could continue his study of the sun. Hale wanted to bring into being his concept of a modern observatory that would serve not only as an observing facility for astronomers but also as a first rate research facility where scientists could study the skies using the interdisciplinary skills of the astronomer, physicist and chemist, supported by workshops employing people with skills in optics, photography, mechanics, carpentry, and electronics. Of all of these skills, Hale believed, a knowledge of physics was the most important for the study of astronomy. Hale's application of physics to the study of astronomy was soon to give birth to a new field of study--astrophysics.

See continuation sheet

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William Harper, as the president of the newly founded University of Chicago, was more concerned with increasing the reputation of the university through the establishment of a first-rate research laboratory, which would attract the best minds in the field of astronomy and bring recognition and honor to his school. Yerkes was to be successful in both regards. ³

In the summer of 1892 George Ellery Hale learned that a pair of 40-inch diameter glass disks, made by the Paris firm of Mantois, were available for purchase. Alvan G. Clark, the great telescope maker of Cambridge, Massachusetts, had tested the glass disks and found them perfect. Hale realized that this was an opportunity to build the largest telescope in the world and approached Harper with the idea. Harper agreed to support the project if a donor could be found to support the grinding of the lens and the building of an observatory. In September 1892 both men visited Charles T. Yerkes, a Chicago street-car magnate, who agreed to underwrite the cost of the project. Eventually, George Ellery Hale had to talk Yerkes into parting with \$349,000 before the project was completed.⁴

Progress on the new observatory moved quickly after Yerkes made his commitment. The glass disks were purchased for \$20,000 and Alvan Clark began the long process of grinding them into the proper shape. The mechanical parts of the telescope were completed in 1893 in time for exhibition at the Columbian Exposition in Chicago. By October 1895 the glass lenses were completed and tested by Hale, who found them excellent.

Construction of the observatory building was begun in 1895 at Williams Bay, Wisconsin, distant enough from the lights of Chicago (76 miles) to assure dark skies, and yet close enough to the city to be readily accessible to the faculty and students of the University of Chicago. The first astronomical observations with the completed telescope were made by Hale and his associates in the summer of 1897. The excellent optical qualities of the new telescope were immediately proven when astronomer Edward Emerson Barnard soon discovered a faint third companion to the star Vega, which had gone undetected even by the skilled astronomer Sherburne W. Burnham using the 36-inch Lick telescope.

Hale was successful in his quest. The new Yerkes Observatory not only possessed the largest telescope but was the most modern and complete observatory in the country. Hale had seen to it that the instrumentation at Yerkes was second to none.

Soon Yerkes began to attract the foremost astronomers in both America and Europe. Sherburne W. Burnham continued his work, begun at Lick, in

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cataloging double stars. With the new 40-inch refractor he was able to measure thousands of neglected and overlooked star pairs, adding precious data to the meager store of information on stellar masses. In 1906 with Hale's support, Burnham published his General Catalog of Double Stars within 121° of the North Pole. This great catalog contained data on 13,665 double and multiple star systems and gave a major boost to double and multiple star astronomy.

Utilizing a fast photographic lens, Edward Barnard took photographs that were compiled into the Photographic Atlas of Selected Regions of the Milky Way, a work that remains a landmark in the study of our galaxy. From 1905-1927 Barnard discovered and mapped the large dark clouds of the Milky Way.

George Ellery Hale continued his own research on the sun at Yerkes with the completion of his spectroheliograph in the Yerkes instrument shop. With this instrument he proved that calcium and hydrogen flocculi seen on the solar disk were vast prominences thrown off by the activity in the Sun's outermost layers.

Ernest Nichols arrived at Yerkes in the summer of 1898 with a radiometer to determine the heat from the stars. Mounted in the heliostat room, the device successfully measured the near-infrared radiation of Arcturus and Vega.

Spectroscopist Walter Adams joined the staff at Yerkes in 1898 and worked with Edwin Frost to measure the radial velocities of B-type stars. Albert Michelson, in experiments at Yerkes, measured double stars with his interferometer while Frank Schlesinger pioneered the photographic determination of stellar parallax, increasing by a factor of 10 the accuracy of distance measurements over those made by visual observations.

Among the other prominent staff members were the optician Frank Ross who introduced the wide-angle lens as an important photographic tool in astronomy. George Ritchey, another Yerkes optical designer, demonstrated how the visually color-corrected 40-inch refractor could be used photographically as well by placing a yellow filter in front of a special photographic plate.

Despite the success of Yerkes, Hale was not satisfied and eventually began to look to California as a site for newer and larger telescopes. During the winter of 1903-04 Hale traveled to Pasadena, California to investigate the possibility of establishing an observatory on Mount Wilson. Once he was satisfied with the new site Hale returned to Yerkes

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Continuation Sheet

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to persuade many of his friends on the staff to join him. Even after Hale's departure, Yerkes continued to attract some of the finest astronomers in the world and produce new information in the study of astronomy.

Astronomer George van Biesbroeck began a program of positional observations of comets and asteroids with the 24-inch reflector. John Parkhurst worked to perfect photometric scales of stellar magnitudes. In 1913 Edwin Hubble worked at Yerkes photographing faint galaxies--a field of research that was to lead him eventually to Mount Wilson, where he was to formulate his concept of the size and nature of the universe. Frank Ross's work in photography began to reveal the faint features of interstellar matter in the galaxy. In the 1930s Otto Struve arrived at Yerkes as a graduate student and stayed eventually to become director. Struve was a superb spectroscopist and made detailed studies of stellar atmospheres, stellar rotation, and binary stars. In 1930 another graduate student, William Wilson Morgan, stayed at Yerkes and worked to determine the distances and luminosities of stars from their spectra. Morgan's work would eventually lead to the discovery of the spiral structure of our galaxy. Astronomer Gerard Peter Kuiper arrived at Yerkes in 1936 as a member of the faculty of the University of Chicago. In 1944, through his research, Kuiper discovered the atmosphere on Titan, a satellite of Saturn. In 1948 Kuiper discovered the fifth satellite of Uranus and in 1949 the second satellite of Neptune.

The Yerkes Observatory, in the century since its establishment by George Ellery Hale, has had a profound impact on the history of the sciences of astronomy and astrophysics. The Yerkes Observatory not only established the format of the modern research observatory but was also the scene for many of the major scientific discoveries in the past century in these fields. In addition, the legions of astronomers who were trained at Yerkes have gone on to work in and, in many cases, direct other observatories, planetaria, and departments of astronomy and astrophysics. Several names readily come to mind: Edwin P. Hubble, who worked on the recession of galaxies, thereby first giving evidence of the expansion of the universe; Walter S. Adams, later the director of Mount Wilson Observatory who did pioneering work in the study of stellar spectra; and William H. Wright, who became the director of Lick Observatory.

George Ellery Hale's plan for Yerkes Observatory was so precise in detail and so broad in scope that he forever changed the science of astronomy and the concept of the modern observatory. Years after its establishment, Yerkes astronomers would say: "Only now are we carrying out many of the ideas Hale planned for. His vision was extraordinary."⁵

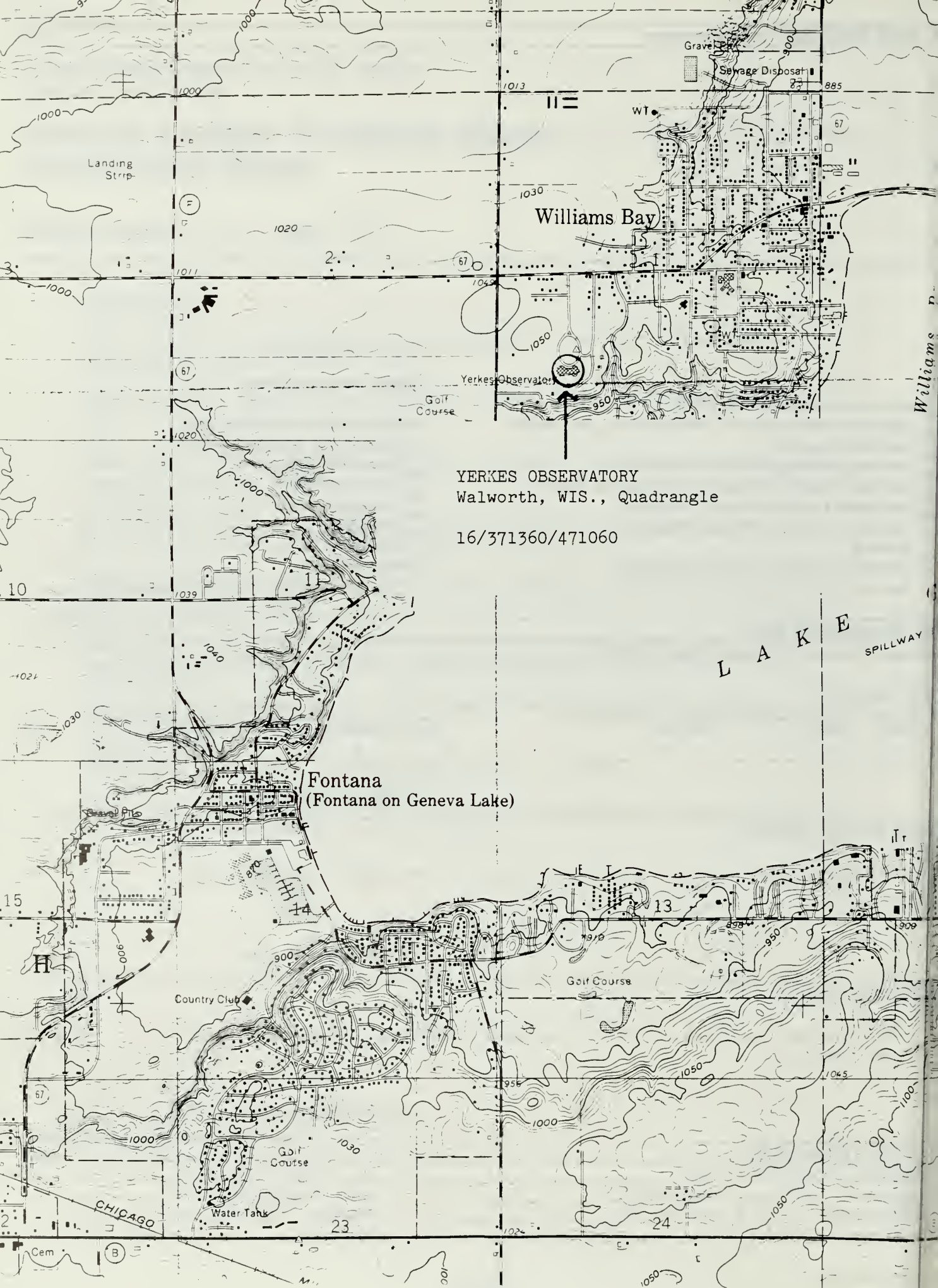
United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 8 Page 5

Footnotes

1. The descriptive material in this section was taken from the following sources.
University of Chicago, "Yerkes Observatory" (U.S.A.: no publisher identified, no date).
Bruce Bond, "A Celebration of Light: Yerkes in Perspective," Astronomy Magazine, December 1982, pp. 6-22.
2. Helen Wright, Explorer of the Universe: A Biography of George Ellery Hale (New York: E.P. Dutton & Co., Inc., 1966), pp. 108-11.
3. The historical background for this section was taken from the following sources.
"Yerkes Observatory" op. cit.
Bruce Bond, op. cit., pp. 6-22.
4. Richard Learner, Astronomy Through the Telescope (New York: Van Nostrand Reinhold Company, 1981), p. 104.
5. Wright, op. cit., 111.

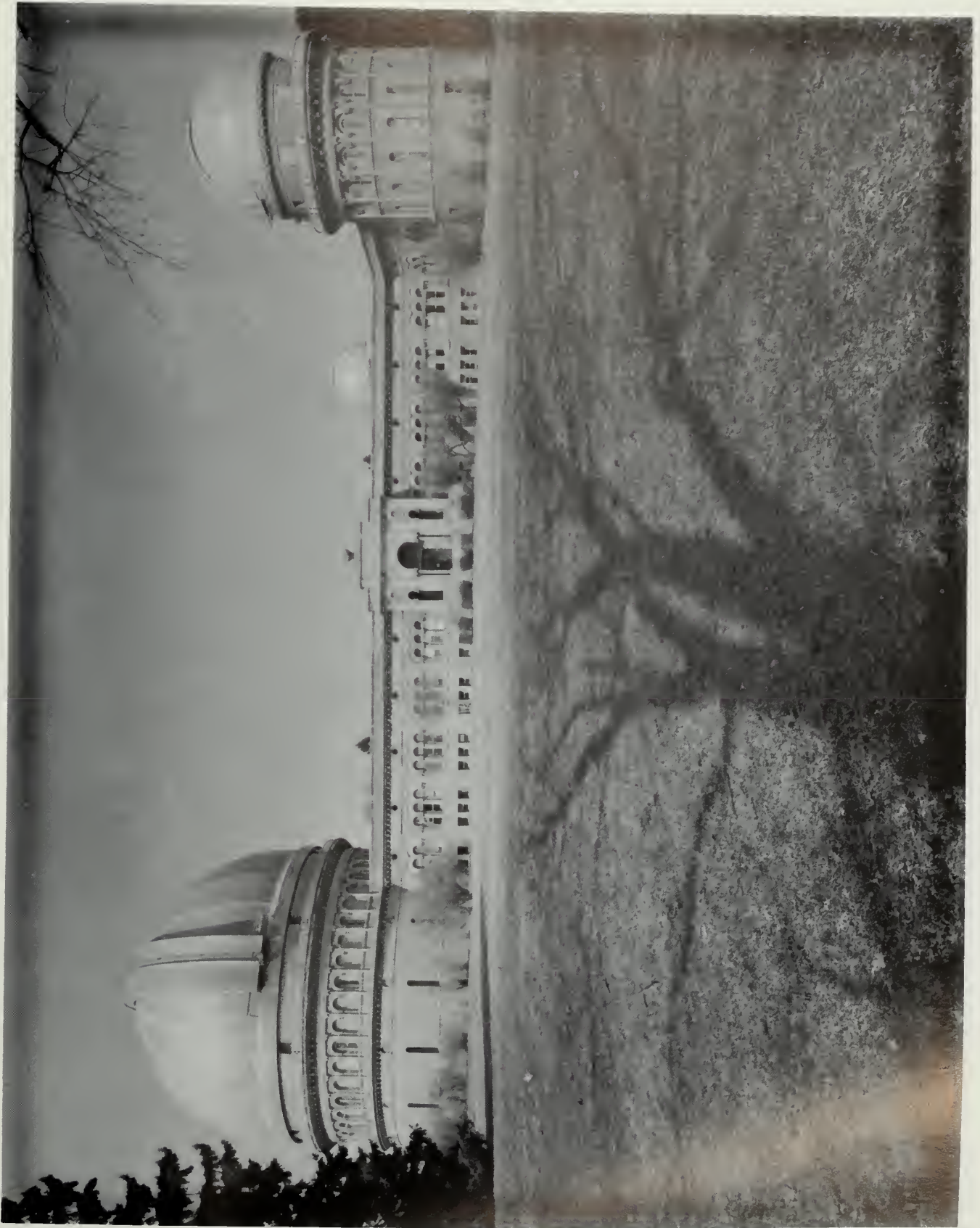


Williams Bay

YERKES OBSERVATORY
Walworth, WIS., Quadrangle
16/371360/471060

Fontana
(Fontana on Geneva Lake)

L A K E
SPILLWAY



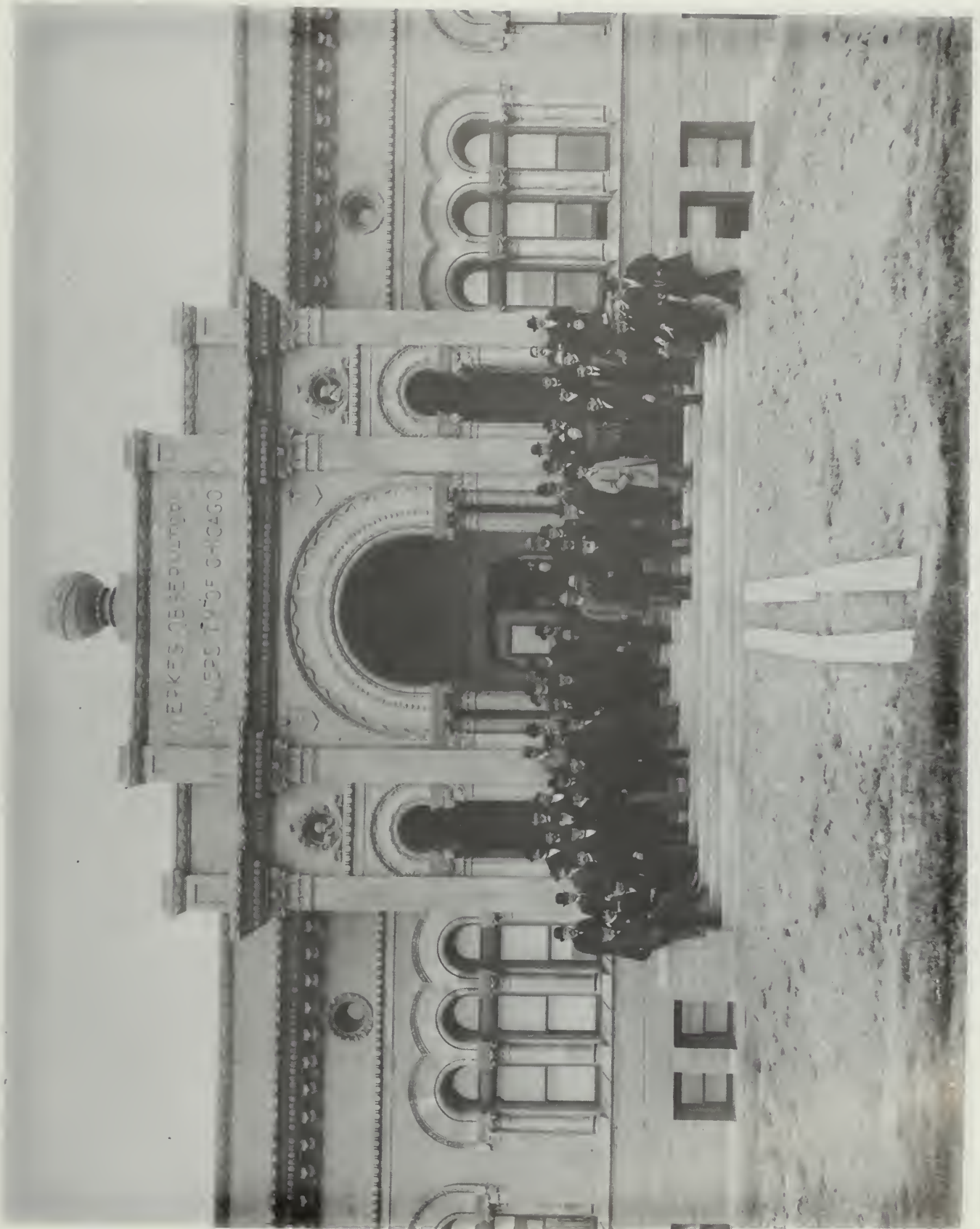
Yerkes Observatory — Williams Bay, Wisconsin
Front View, 1988

Photo Credit: Yerkes Observatory



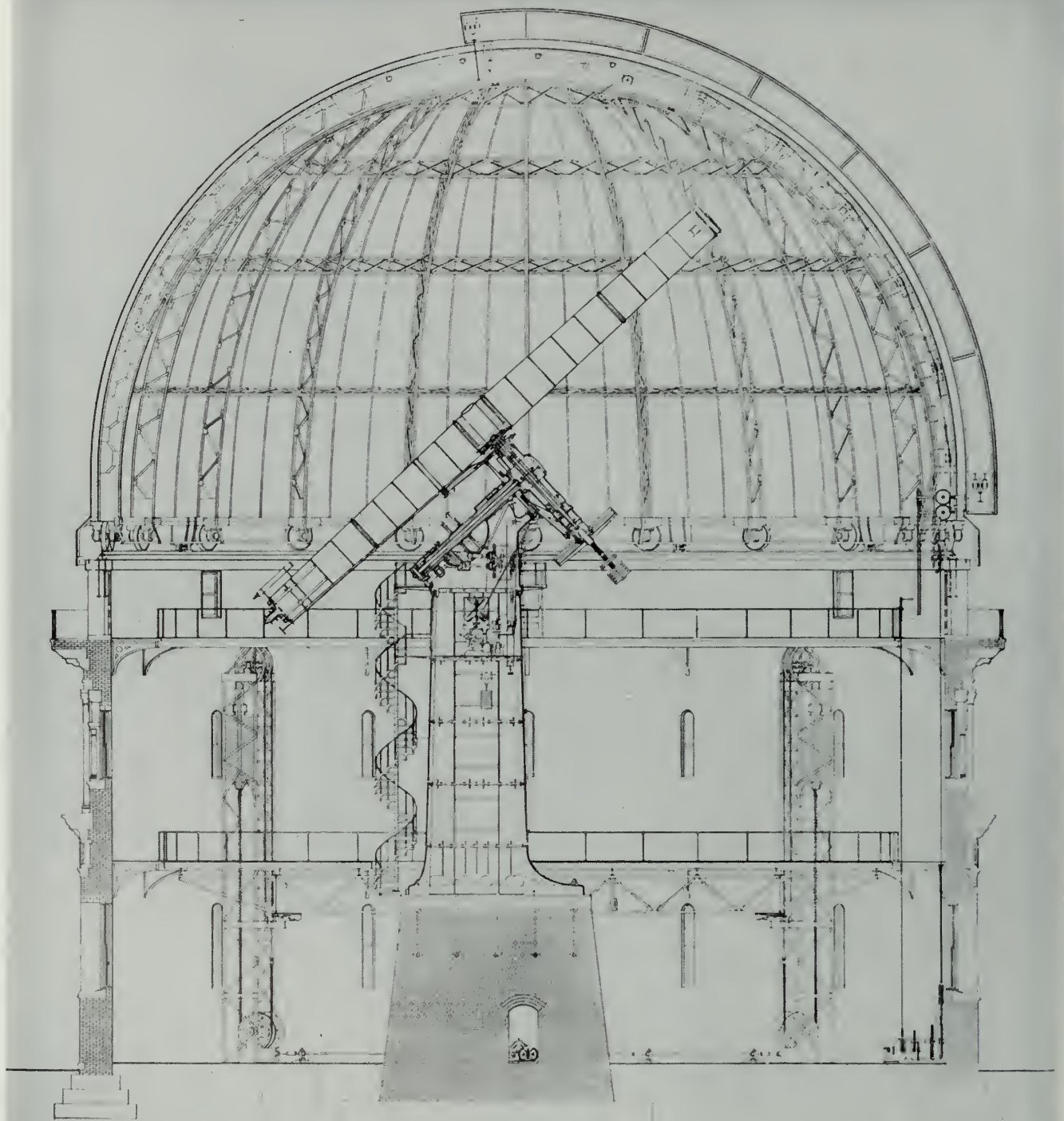
Yerkes Observatory — Williams Bay, Wisconsin
Front View, 1988

Photo Credit: Yerkes Observatory



Yerkes Observatory — Williams Bay, Wisconsin
Dedication, 1897

Photo Credit: Yerkes Observatory



DESIGNED AND CONSTRUCTED BY
WARNER & SWASEY
 107 N. W. 10th St. S. P. O. B. 107
 ST. LOUIS, MO. U.S.A.
 1897

40 INCH REFRACTOR
 107 N. W. 10th St. S. P. O. B. 107
 ST. LOUIS, MO. U.S.A.
 1897

Plate XXXIV

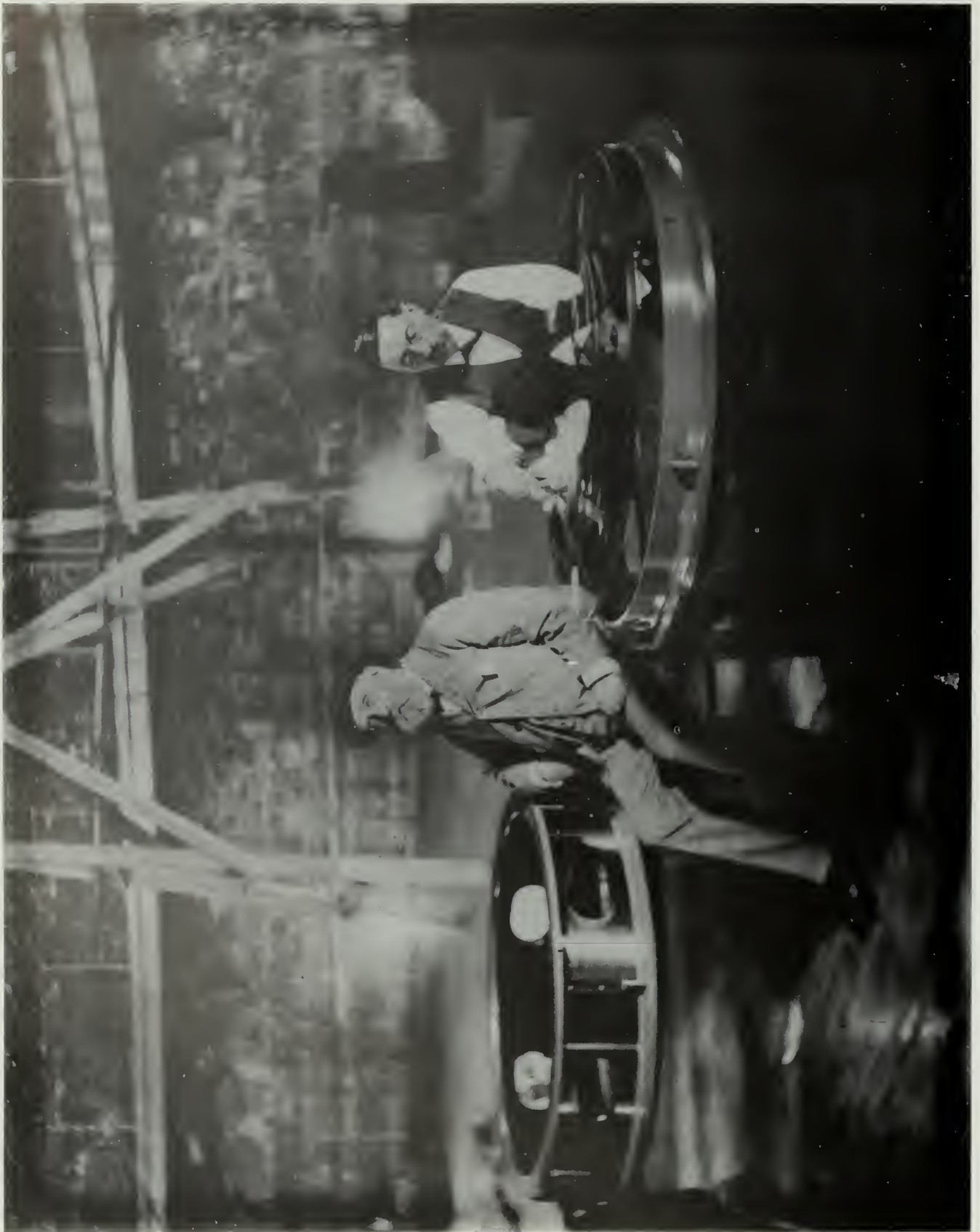
Yerkes Observatory — Williams Bay, Wisconsin
 Design and Construction Drawing for 40-inch Refractor and Dome, 1897

Photo Credit: Yerkes Observatory



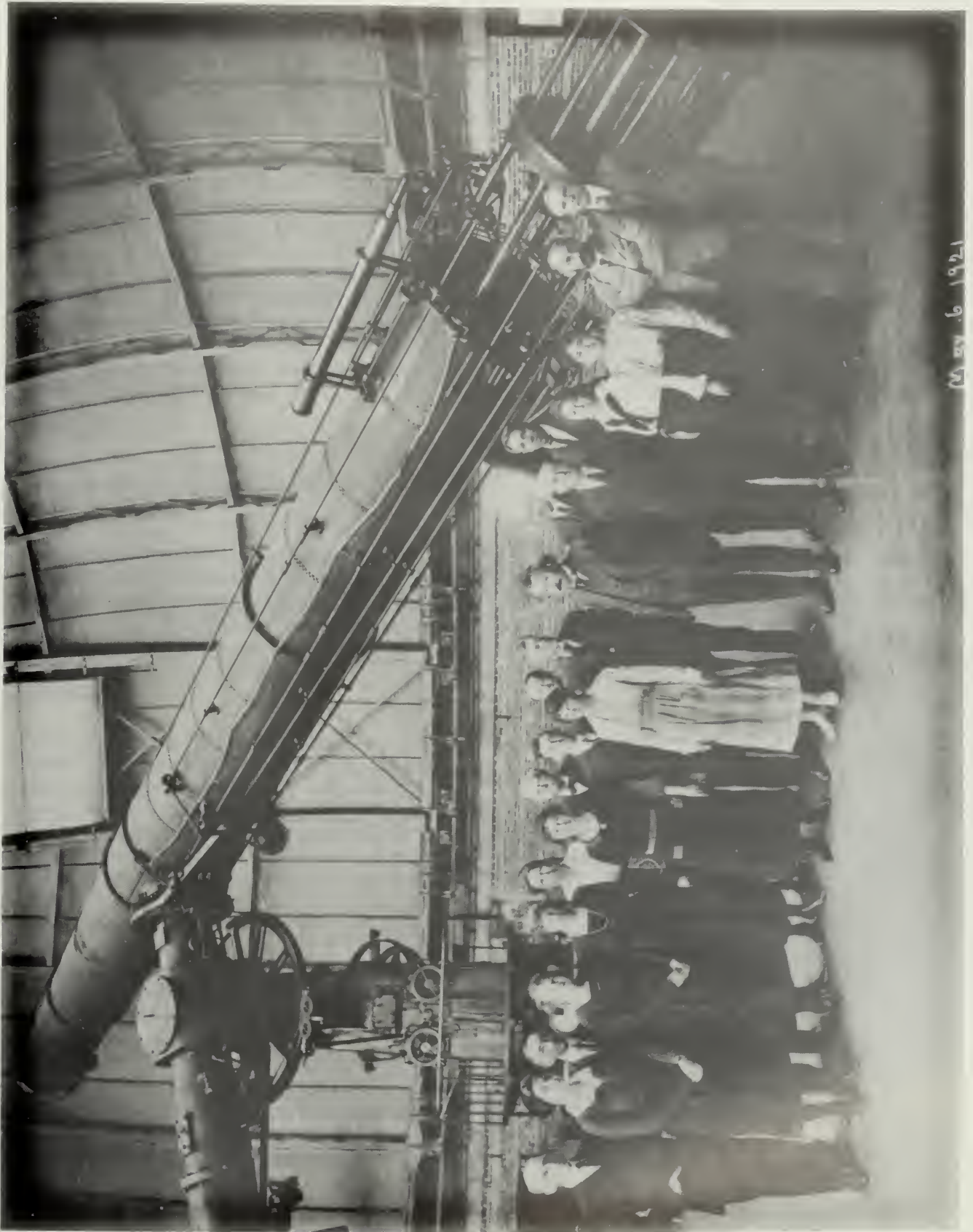
Yerkes Observatory — Williams Bay, Wisconsin
40-inch Refractor Telescope, 1988

Photo Credit: Yerkes Observatory



Yerkes Observatory — Williams Bay, Wisconsin
Alvin Clark and his assistant Charles Lundin (Right) alongside of the 40-inch Lens, 1896

Photo Credit: Yerkes Observatory



Yerkes Observatory — Williams Bay, Wisconsin
Albert Einstein and the staff of the Observatory in front of the 40-inch Refractor, 1921

Photo Credit: Yerkes Observatory

NATIONAL REGISTER SITES CONSIDERED BUT NOT RECOMMENDED FOR DESIGNATION
AS NATIONAL HISTORIC LANDMARKS

ALABAMA

Old Observatory
University of Alabama
Tuscaloosa, Alabama

Listed in the National Register in 1972 as significant in architecture and education. The Old Observatory is a small white Greek Revival building built in 1844 under the supervision of Frederick A.P. Barnard, professor of chemistry and mathematics (1837-54) and later president of Columbia University. The observatory currently houses the offices of the consulting engineer of the University of Alabama.

ARIZONA

Harquahala Peak Observatory
Yuma, Arizona

Listed in the National Register in 1975 as significant in science. From 1920 to 1925 the Harquahala Peak Observatory was operated by the Smithsonian Institution for the purpose of taking solar observations and measuring solar constants. In 1925 the observatory was moved to Table Mountain, California. Only two buildings and no equipment remain. Both buildings are in poor condition.

CALIFORNIA

Smithsonian Institution Shelter
Mount Whitney (Sequoia National Park)
California

Listed in the National Register in 1976 as significant in science. The shelter was built in 1909 to house visiting scientists on the summit of Mount Whitney during their studies of solar radiation.

COLORADO

Chamberlain Observatory
University of Denver
2930 East Warren Avenue
Denver, Colorado

Listed in the National Register in 1980 as significant in architecture, education and science. The Chamberlain Observatory was completed in 1891 in the Richardsonian Romanesque style. The lens for the 20-inch refractor was made by Alvan Graham Clark.

DISTRICT OF COLUMBIA

Georgetown University Astronomical Observatory
Georgetown University
Washington, DC.

Listed in the National Register in 1973 as significant in the areas of architecture, education and science. The observatory is a small Greek Revival structure that was completed in 1844. The observatory is no longer used due to the glare of the night lights of the city of Washington. The building is now used to store water samples for the Biology Department. The original 5-inch refractor and a later 12-inch refractor are still used by the astronomy club of the university.

INDIANA

Earlham College Observatory
Earlham College
Richmond, Indiana

Listed in the National Register in 1975 as significant in architecture, education and science. The observatory was completed in 1861 as a simple unadorned early Victorian educational building. The observatory contains a 6.5-inch refracting telescope purchased from pioneer American astronomer R. B. Rutherford, a transit telescope, and a German astronomical clock purchased in 1861.

McKim Observatory
DePauw University
Greencastle, Indiana

Listed in the National Register in 1978 as significant in education and science. The McKim Observatory was completed in 1884 and contains a 9.53-inch refracting telescope made by Alvan Clark on a Warner and Swasey mounting.

MASSACHUSETTS

Harvard University Observatory
Sears Tower
60 Cambridge Street
Cambridge, Massachusetts

The Sears Tower of the Harvard University Observatory was listed in the National Register in 1986 as part of a larger thematic nomination titled, "The Cambridge Multiple Resources Area Nomination." The Sears Tower was previously considered for National Historic Landmark designation in 1964 under Volume XX or the "Arts and Sciences" theme study but was deferred at that time by the National Park System Advisory Board until the completion of a general theme study considering other astronomical observatories.

Although the Sears Tower is an important astronomical observatory dating back to 1844 and associated with the productive careers of astronomers William Cranch Bond (1789-1859) and Edward C. Pickering (1846-1919), the building and its surroundings have been drastically altered in the last one hundred years and no longer possess sufficient integrity to be considered for designation as a National Historic Landmark. Only the central core of the observatory with the 15-inch telescope remains intact. Both of the original flanking wings containing the astronomy professor's residence to the east and classrooms and library to the west have been replaced by modern buildings. The original entry way and heavy granite door frame has been blocked by later additions. Only one of the original iron balconies surrounding the dome, used to set up smaller telescopes, remains intact. The original open space surrounding the Sears Tower is now filled with modern university buildings.

MICHIGAN

Detroit Observatory
University of Michigan
Observatory and Anne Streets
Ann Arbor, Michigan

Listed in the National Register in 1972 as significant in architecture, education and science. The Detroit Observatory was constructed in 1854 combining both Greek Revival and Italianate elements under the direction of Henry Philip Tappan, president of the University of Michigan. The original 12-inch refracting telescope was made by American telescope maker Henry Fitz in 1854.

MINNESOTA

Goodsell Observatory
(New Observatory)
Carleton College
Northfield, Minnesota

Listed in the National Register in 1975 in architecture, communications, education, engineering, literature and science. The Goodsell Observatory was completed in 1887 as a Romanesque Revival style building. The observatory contains an 8-1/4-inch refracting telescope built by the firm of Alvan Clark and Sons of Cambridge, Massachusetts and a 16-inch refractor telescope made by John Brashear. The observatory is also associated with the work of William Wallace Payne, a mathematician and astronomer who was responsible (1882) for the establishment of Popular Astronomy Magazine.

MISSISSIPPI

Barnard Observatory
University of Mississippi
Oxford, Mississippi

Listed in the National Register in 1978 as significant in architecture and education. The Barnard Observatory was completed in 1859 as a two-story red brick structure of Greek Revival design. Chancellor Frederick A.P.

Barnard built the observatory to house a large telescope that would make the university an unrivaled center for the study of astronomy. Barnard ordered a large 19-inch lens from the firm of Alvan Clark in Cambridge, Massachusetts for his telescope, but the outbreak of the Civil War prevented the delivery of the lens. The lens was eventually acquired by the Dearborn Observatory at Northwestern University. The observatory building now houses the Center for the Study of Southern Culture

OHIO

Ohio Wesleyan University Student Observatory
(Perkins Observatory)
Ohio Wesleyan University
West William Street
Delaware, Ohio

The Ohio Wesleyan Student Observatory was listed in the National Register in 1985 as part of a multiple resource nomination for titled, "Ohio Wesleyan University Thematic Group." The buildings in the nomination are listed as significant in the areas of architecture and education. The Perkins Observatory was constructed in 1900 and contains a 32-inch reflecting telescope, one of the largest in the country that the public may look through.

WISCONSIN

Buckstaff Observatory
University of Wisconsin
2119 North Main Street
Oshkosh, Wisconsin

Listed in the National Register in 1979 as significant in the areas of education, science and associated with the career of Ralph N. Buckstaff, a prominent local industrialist who headed a family furniture and cabinet making business. Buckstaff, with no formal scientific training, began the observatory in 1924 for the study of astronomy and meteorology. The Buckstaff Observatory was sold to a private company recently and is no longer associated with the University of Wisconsin. The building may no longer be extant.

University of Wisconsin-Madison
Washburn Observatory
Madison, Wisconsin

Listed in the National Register in 1985 as significant in architecture, education and science. The Washburn Observatory was completed in 1882 as an Italianate style building. The observatory contains a 15-1/2-inch refracting telescope completed by Alvan Clark and Sons of Cambridge, Massachusetts.

The following sites are listed in the National Register as "Observatories" but are not astronomical observatories.

MAINE

Portland Observatory
138 Congress Street
Portland, Maine

The Portland Observatory is a signal tower built in 1807. This site should be evaluated for national significance under the Maritime Theme Study.

NEW HAMPSHIRE

Weston Observatory
Oak Hill, Derryfield Park
Manchester, New Hampshire

The Weston Observatory was built in 1887 as an observation tower for the citizens of Manchester, New Hampshire.

OTHER SITES CONSIDERED BUT NOT RECOMMENDED FOR NATIONAL HISTORIC LANDMARK
DESIGNATION

The following sites were considered for designation as National Historic Landmarks under this theme but were rejected due to lack of integrity and/or failure to establish national significance. Those sites noted with an * are believed to be eligible for listing in the National Register of Historic Places.

CALIFORNIA

Ukiah International Latitude Observatory*
Ukiah, California

The Ukiah International Latitude Observatory was one of six astronomical stations established in the northern hemisphere in 1899 for the purpose of making systematic latitude observations. A sister station, the Gaithersburg Latitude Observatory, has been recommended for designation as a National Historic Landmark. The Ukiah Observatory should be nominated to the National Register of Historic Places and evaluated for National Historic Landmark designation. At this writing no information is available concerning this site.

CONNECTICUT

Van Vleet Observatory*
Wesleyan University,
Middletown, Connecticut

Although the history of this observatory dates back to 1838 the present telescope and structure date from 1915. The 1838 observatory was demolished in 1868. The 1868 observatory was demolished in 1915. The current observatory dates from 1916. Since 1925 the chief research problem worked on at the Van Vleck Observatory has been the determination of stellar parallaxes.

DISTRICT OF COLUMBIA

Natural History Museum
Auditorium
Smithsonian Institution
Washington, DC.

Site of the April 26, 1920, debate between Dr. Harlow Shapley and Dr. Herber D. Curtis concerning the size, nature, and extent of the universe. The debate was sponsored by the National Academy of Sciences. Attendees included Albert Einstein, Robert A. Millikan, George A. Hale, A.A. Michelson, and other leaders of the American astronomical community.

ILLINOIS

Northwestern University*
Dearborn Observatory
Evanston, Illinois

Used by astronomer George Washington Hough (1836-1909) to study double stars and to carry through long-term observations of the planet Jupiter. The lens for the 18-1/2-inch refractor at the Dearborn Observatory was completed by Alvan Clark (1804-1887) in 1861. In 1862, while testing this lens, Clark observed the dark companion star orbiting Sirius. Clark received a medal from the French Academy of Science for this achievement.

MASSACHUSETTS

Maria Mitchell Observatory*
Vestal Street
Nantucket, Massachusetts

Maria Mitchell (1818-1889) was America's first woman astronomer and the first woman to be admitted to the American Academy of Arts and Sciences. As a young girl she helped her father, William, a Nantucket astronomer, with his observations. On October 1, 1847, Maria Mitchell discovered a comet and won international recognition. The observatory building was constructed in 1908 and incorporates part of her birthplace and family home on Nantucket.

Hopkins Observatory*
Williams College
Williamstown, Massachusetts

The Hopkins Observatory is associated with the career of Professor Albert Hopkins who traveled to Europe in 1834-35 and brought back many astronomical instruments, including a Herschelian reflector of 10-foot focal length. The Observatory building dates to 1868 and is one of the oldest extant observatory buildings in the United States today.

NEW JERSEY

Princeton University
Fritz Randolph Observatory
Princeton, New Jersey

Associated with the work of Henry Norris Russell (1877-1957) who was the director of the Princeton Observatory from 1912 to 1921. Russell was the co-discoverer, with Ejnar Hertzsprung, of the Hertzsprung-Russell Diagram, which showed there was a relationship between a star's brightness and color. After 1921 Russell moved to the Mount Wilson Observatory. Harlow Shapley studied here as a graduate student in astronomy under the direction of Henry Norris Russell. The present observatory building dates from 1934. An original Rittenhouse Orrery is on display in the building.

NEW YORK

Vassar College Observatory*
Poughkeepsie, New York

Associated with the career of Maria Mitchell (1818-89), an early American woman astronomer. In 1865 Mitchell was appointed to the chair of astronomy and director of the observatory at Vassar where she studied the Sun, Jupiter, and Saturn.

PENNSYLVANIA

David Rittenhouse Birthplace*
207 Lincoln Drive
Philadelphia, Pennsylvania

David Rittenhouse (1732-1796) was important in the fields of astronomy and mathematics. In order to observe the transit of Venus in 1769, Rittenhouse constructed the first telescope to be made in America. Rittenhouse also constructed orreries, or "mechanical planetariums." An orrery is a mechanical apparatus which illustrates with balls of various sizes the relative motions and positions of the planets.

This site was rejected in the 1964 Arts and Sciences theme study because Rittenhouse lived there only as a youth and it is bare of original furniture. The study did not identify any other Rittenhouse sites.

Sproul Observatory*
Swarthmore, Pennsylvania

Associated with Peter Van De Kamp (1901-), who claimed to have discovered (1963) the nearest planetary system to our own star, orbiting the red dwarf known as Barnard's Star.

TEXAS

McDonald Observatory*
Fort Davis, Texas
(Mount Locke, Texas)

The McDonald Observatory was dedicated in 1939 as a result of a joint agreement between the Universities of Chicago and Texas to establish and jointly operate a new observatory in the western part of North America. The observatory contains both 107-inch and 82-inch reflecting telescopes and a 36-inch Cassegrain telescope. In the years since 1939 the McDonald Observatory has been the site of many famous astronomical discoveries, including the discovery of a satellite of Uranus and a satellite of Neptune, the existence of hydrogen atoms in interstellar space and evidence for the seasonal variation of water vapor on Mars.

VIRGINIA

Leander McCormick Observatory*
Charlottesville, Virginia

This observatory contains a 26-inch Alvan Clark refractor that has contributed to thousands of parallax determinations essential for establishing the first mileposts out into the galaxy.

SITES LESS THAN 50 YEARS OLD

ALL OF THE SITES LISTED BELOW ARE LESS THAN 50 YEARS OLD AND SHOULD BE RE-EXAMINED FOR NATIONAL SIGNIFICANCE IN THE FUTURE.

ARIZONA

Kitt Peak National Observatory
950 North Cherry Avenue
Tucson, Arizona
1958

Kitt Peak hosts 16 telescopes and represents the largest concentration of astronomical instruments in the world.

U.S. Naval Observatory
Flagstaff, Arizona
1955

This observatory houses a 40-inch Ritchey-Chretien telescope that was originally put into operation by the U.S. Naval Observatory in Washington, DC., in 1934. Due to increasing light and air pollution in Washington the telescope was moved to Flagstaff, Arizona in 1955. This telescope is the last instrument built by George W. Ritchey.

DISTRICT OF COLUMBIA

Naval Research Laboratory
4555 Overlook Avenue, SW
Washington, DC
1950

Immediately after World War II, apart from the completion in 1946, of the U.S. Army Signal Corps project to detect radar echoes from the moon, the only important work in radio astronomy took place here. Research started by J.P. Hagen, F.T. Haddock, and others represented a highly significant step, leading the way in short wave length radio astronomy, and strongly influencing the pattern of much subsequent research. The 50 ft. parabolic reflector, completed in 1950, was the first radio telescope built to operate at wave lengths down to 1 cm.

NEW MEXICO

Sacramento Peak Solar Observatory
Sunspot, New Mexico
1950

The Sacramento Peak Solar Observatory is found in the Lincoln National Forest and contains a 136-foot tower telescope dedicated to observing the sun.

OHIO

Kraus Reflector Radio Telescope
Ohio State University
1962

This radio telescope, designed by J.D. Kraus, is a long reflector having limited steering, with the long dimension parallel to the ground. This type of telescope was an attractive idea for the economical construction of a large, partially steerable radio telescope.

PUERTO RICO

Arecibo (Radio) Telescope
Puerto Rico
1963

Site of the world's largest radio astronomy dish. Used for ionospheric studies, radar mapping of the moon and planets, and radio astronomy. Arecibo has played a major role in identifying some of the most mysterious signals received on Earth--pulsars, quasars and natural hydrogen emissions from the galaxies.

WEST VIRGINIA

National Radio Astronomy Observatory
Greenbank, West Virginia
1955

The National Radio Astronomy Observatory came into being in 1955 as a result of a grant from the National Science Foundation to Associated Universities, Inc., to establish a national radio astronomy observatory for scientific research. The first radio telescope constructed at Greenbank was the 85-foot Tatel Telescope. One telescope at this site, the Reber radio telescope, is being recommended for designation in this theme because its significance predates the establishment of the observatory. Another instrument, the 300-foot radio telescope, was under consideration for designation when it collapsed in late 1988.

SITES THAT ARE NO LONGER EXTANT

ILLINOIS

Grote Reber House
212 West Seminary Road
Wheaton, Illinois
Demolished (Now a public park)

Beginning in 1935, Grote Reber constructed the world's first radio telescope here, in the backyard of his house, and began to pursue the study of radio astronomy, following the discoveries of Karl Jansky. The original Reber radio telescope is now found at the National Radio Astronomy Observatory in Greenbank, West Virginia.

MASSACHUSETTS

Alvan Clark Home, Workshop and Observatory
184 Brookline Street
Cambridge, Massachusetts
Demolished in 1923.

Alvan Clark, the famous American telescope maker, directed his firm, Alvan Clark & Sons, from this location from 1860 until his death in 1887. The firm continued to operate first under the direction of Alvan Clark's sons, and after their deaths, under the direction of Carl Axel Robert Lundin until his death in 1915. The property was demolished in 1923.

NEW JERSEY

Jansky Rotating Antenna
Bell Labs
Holmdel, New Jersey
Demolished

Working at the Bell Telephone Laboratories in 1933, Karl Guthe Jansky (1905-1950) was the first person to detect radio emissions from gases lying between the stars of the Milky Way, thus establishing the foundation for the science of radio astronomy. Jansky never followed up his discovery and the field of radio astronomy was left to Grote Reber from Wheaton, Illinois to continued his research. Jansky's Rotating Antenna was broken up soon after he ceased his research. An exact replica, constructed from the original drawings by the same man who built the original, now stands as a memorial to Jansky at the entrance of the National Radio Astronomy Observatory in Greenbank, West Virginia.

EXISTING NATIONAL HISTORIC LANDMARKS FOR ASTRONOMY

The 1987 edition of History and Prehistory in the National Park System and the National Historic Landmarks Program lists only two sites as National Historic Landmarks because of their significance in the history of astronomy-- the Edwin P. Hubble House and the Lowell Observatory.

ARIZONA

Lowell Observatory
1 mile west of Flagstaff, Arizona

Astronomical research here has contributed greatly to the knowledge of the universe. First evidence of expansion of the universe was obtained at Lowell in 1912. In 1930 astronomer Clyde Tombaugh used a special wide-angle 13-inch astrographic telescope to discover the planet Pluto. NHL designated December 21, 1965.

CALIFORNIA

Hubble (Edwin) House
1340 Woodstock Road
San Marino, Los Angeles County
California

Home of one of America's greatest 20th century astronomers who, among other accomplishments, discovered extragalactic nebulae and their recession from each other. NHL designated December 8, 1976.

EXISTING NATIONAL HISTORIC LANDMARKS IN OTHER THEMES

The National Historic Landmarks listed below were all identified as significant in other themes. These sites should also be listed for astronomy in addition to their primary themes.

DISTRICT OF COLUMBIA

Administration Building, Carnegie
Institution of Washington
1530 P Street, NW
Washington, DC

Built with funds donated by Andrew Carnegie, the Institution operates the Mount Wilson Observatory and conducts research in the physical and biological sciences. NHL designated June 23, 1965.

Old Naval Observatory
23rd and E Streets, NW
Washington, DC

The Old Naval Observatory originally housed a 26-inch refracting telescope built by Alvan Clark and Sons in 1870. Astronomer Asaph Hall used this telescope to discover the two Martian satellites, Deimos and Phobos, in 1877. This discovery greatly enhanced Clark's reputation as a master telescope builder. The Old Naval Observatory is also associated with the work of Simon Newcomb (1835-1909), Canadian-born American astronomer, who was one of the foremost of all mathematical astronomers. Starting in 1875 Newcomb began a series of observations to prepare more accurate tables of observations of lunar and planetary motions. The results, published in the Nautical Almanac, were used through the first half of the 20th century. In 1893 the U.S. Naval Observatory moved from this location to Massachusetts Avenue at 34th St., NW. NHL designated January 12, 1965.

ILLINOIS

Millikan (Robert A.) House
5605 Woodlawn Avenue
Chicago, Cook County
Illinois

One of America's best known 20th-century scientists, Millikan received the 1923 Nobel Prize in physics for his work in demonstrating the existence of electrons. In Millikan's later years he investigated the origin and nature of cosmic rays. NHL designated May 11, 1976.

MASSACHUSETTS

Bowditch (Nathaniel) Home
North Street
Salem, Essex County
Massachusetts

Bowditch effected great advances in navigation and helped bring European mathematics to America. (Bowditch was also an important early American astronomer who was elected to the Royal Astronomical Society in 1829, the first American to be so honored.) NHL designated January 12, 1965.

NEW YORK

Draper (John W.) House
Draper Park
407 Broadway
Hastings-on-Hudson
Westchester County, New York

Home of the well-known mid-19th-century scientist who, in addition to significant contributions to physics and chemistry, also wrote important works in intellectual history. Draper was the first person to succeed in photographing a stellar spectrum. NHL designated May 15, 1975.

VIRGINIA

Banneker (Benjamin) SW-9
Intermediate Boundary Stone
18th and Van Buren Streets
Arlington County, Virginia

This boundary stone commemorates the accomplishments of Benjamin Banneker, a gifted mathematician, (and astronomer), who helped survey the District of Columbia and who was at that time the most famous Black man in America. NHL designated May 11, 1976.

WYOMING

Medicine Wheel
15 miles northeast of Kane
Big Horn County
Wyoming

Made of loose, irregularly shaped, whitish flat stones placed in a circle. Twenty-eight linear spokes, 70-75 feet in length, radiate from the hub. The National Historic Landmark form states that its intended purpose is unknown. (This site is often referred to as the "Stonehenge of the West." It has been found to be aligned to the rising and setting positions of the summer solstice sun, and the rising of three bright stars of the summer sky on that longest day of the year. Significant in Archeoastronomy.) NHL designated August 29, 1970.

GLOSSARY

absorption spectrum - Dark lines superimposed on a continuous spectrum.

achromatic - Free of chromatic aberration.

almanac - A book or table listing astronomical events.

altazimuth mounting - a mounting with two axes, to allow movement in both horizontal and vertical planes, used with telescopes, antennas and precise surveying instruments.

astrometry - That branch of astronomy that deals with the determination of precise positions and motions of celestial bodies.

astronomical unit (AU) - a unit of length equal to the mean radius of the earth's orbit around the sun (93 million miles).

astronomy - The branch of science that treats of the physics and morphology of that part of the universe that lies beyond the earth's atmosphere.

astrophysics - The part of astronomy that deals principally with the physics of stars, stellar systems, and interstellar material. Astrophysics also deals with the structures and atmospheres of the sun and planets.

atmospheric refraction - The bending or refraction of light rays from celestial objects by the earth's atmosphere.

azimuth - The angle along the celestial horizon, measured eastward from the north point, to the intersection of the horizon with the vertical circle passing through an object.

bands (in spectra) - Emission or absorption lines, usually in the spectra of chemical compounds or radicals, so numerous and closely spaced that they coalesce into broad emission or absorption bands.

"big bang" theory - A theory of cosmology in which the expansion of the universe is presumed to have begun with a primeval explosion.

bolometric magnitude - A measure of the flux of radiation from a star or other object received just outside the earth's atmosphere, as it would be detected by a device sensitive to all forms of electromagnetic energy.

calculus - A branch of mathematics that permits computations involving rates of change (differential calculus) or of the contribution of an infinite number of infinitesimal quantities (integral calculus).

cassegrain focus - An optical arrangement in a reflecting telescope in which light is reflected by a second mirror to a point behind the objective mirror.

celestial equator - A great circle on the celestial sphere 90° from the celestial poles; the circle of intersection of the celestial sphere with the plane of the earth's equator.

celestial poles - Points about which the celestial sphere appears to rotate, intersections of the celestial sphere with the earth's polar axis.

cepheid variable - A star that belongs to one of two classes (type I and type II) of yellow supergiant pulsating stars.

charged-coupled device (CCD) - An array of electronic detectors of electromagnetic radiation, used at the focus of a telescope (or camera lens). A CCD acts like a photographic plate of very high sensitivity.

chromatic aberration - A defect of optical systems whereby light of different colors is focused at different places.

constellation - A configuration of stars named for a particular object, person, or animal; or the area of the sky assigned to a particular configuration.

continuous spectrum - A spectrum of light comprised of radiation of a continuous range of wavelengths or colors rather than only certain discrete wavelengths.

corona - Outer atmosphere of the sun.

coronagraph - An instrument for photographing the chromosphere and corona of the sun outside of eclipse.

cosmic background radiation - The microwave radiation coming from all directions that is believed to be the redshifted glow of the big bang.

cosmic rays - Atomic nuclei (mostly protons) that are observed to strike the earth's atmosphere with exceedingly high energies.

cosmology - The study of the organization and evolution of the universe.

coude focus - An optical arrangement in a reflecting telescope whereby light is reflected by two or more secondary mirrors down the polar axis of the telescope to a focus at a place separate from the moving parts of the telescope.

diffraction - The spreading out of light in passing the edge of an opaque body.

diffraction grating - A system of closely spaced equidistant slits or reflecting strips which, by diffraction and interference, produce a spectrum.

dispersion - Separation, from white light, of different wavelengths being refracted by different amounts.

doppler shift - Apparent change in wavelength of the radiation from a source due to its relative motion in the line of sight.

eclipsing binary star - A binary star in which the plane of revolution of the two stars is nearly edge on to our line of sight, so that the light of one star is periodically diminished by the other passing in front of it.

electromagnetic radiation - Radiation consisting of waves propagated through the building up and breaking down of electric and magnetic fields; these include radio, infrared, light, ultraviolet, X rays, and gamma rays.

emission line - A discrete bright spectral line.

ephemeris - A table that gives the position of a celestial body at various times, or other astronomical data.

equatorial mount - A mounting for a telescope, one axis of which is parallel to the earth's axis, so that a motion of the telescope about the axis can compensate for the earth's rotation.

faculus (pl. faculae) - Bright region near the limb of the sun.

flash spectrum - The spectrum of the very limb of the sun obtained in the instant before or after totality in a solar eclipse.

flocculus (pl. flocculi) - A bright region of the solar surface observed in the monochromatic light of some spectral line.

fluorescence - The absorption of light of one wavelength and reemission of it at another wavelength; especially the conversion of ultraviolet into visible light.

focal length - The distance from a lens or mirror to the point where light converged by it comes to a focus.

focal ratio (speed) - Ratio of the focal length of a lens or mirror to its aperture.

focus - Point where the rays of light converged by a mirror or lens meet.

Fraunhofer line - An absorption line in the spectrum of the sun or a star.

Fraunhofer spectrum - The array of absorption lines in the spectrum of the sun or of a star.

galaxy - A large assemblage of stars; a typical galaxy contains millions to hundreds of million of stars.

globular cluster - One of about 120 large star clusters that form a system of clusters centered on the center of the Galaxy.

Greenwich meridian - The meridian of longitude passing through the site of the old Royal Greenwich Observatory, near London; origin point from which longitude is measured on the earth.

Hertzsprung-Russell (H-R) diagram - A plot of absolute magnitude against temperature (or spectral class or color index) for a group of stars.

hypothesis - A tentative theory or supposition, advanced to explain certain facts or phenomena, which is subject to further tests and verification.

interferometer (stellar) - An optical device, making use of the principle of interference of light waves, with which small angles can be measured.

latitude - A north-south coordinate on the surface of the earth; the angular distance north or south of the equator measured along a meridian passing through a place.

light - Electromagnetic radiation that is visible to the eye.

light year - The distance light travels in a vacuum in one year; one light year equals approximately 6,000,000,000,000 miles.

longitude - An east-west coordinate on the earth's surface; the angular distance, measured east or west along the equator from the Greenwich meridian, to the meridian passing through a place.

luminosity - The rate of radiation of electromagnetic energy into space by a star or other object.

magnitude - A measure of the amount of light flux received from a star or other luminous object.

maser - An acronym for microwave amplification of stimulated emission radiation; a device for amplifying a microwave (radio) signal at a particular wavelength into a coherent beam.

microwave - Short-wave radio wavelengths.

Milky Way - The band of light encircling the night sky, which is due to the many stars and diffuse nebulae lying near the plane of our Galaxy.

monochromatic - Of one wavelength or color.

Newtonian focus - An optical arrangement in a reflecting telescope, in which a flat mirror intercepts the light from the primary mirror before it reaches the focus and reflects it to a focus at the side of the telescope tube.

Newton's laws - The laws of mechanics and gravitation formulated by Isaac Newton.

nova - A star that experiences a sudden outburst of radiant energy, temporarily increasing its luminosity by hundreds to thousands of times.

objective - The main lens or mirror of a telescope. The larger it is, the brighter the image is and the sharper it is (i.e., its resolution is better).

opacity - Absorbing power; capacity to impede the passage of light.

optics - The branch of physics that deals with light and its properties.

parallax - An apparent displacement of an object due to a motion of the observer.

parallax (stellar) - An apparent displacement of a nearby star that results from the motion of the earth around the sun; numerically, the angle subtended by 1 AU at the distance of a particular star.

photocell (photoelectric cell) - An electron tube in which electrons are dislodged from a cathode when it is exposed to light and are accelerated to an anode, thus producing a current in the tube, whose strength serves as a measure of the intensity of the light striking the cathode.

photographic magnitude - The magnitude of an object, as measured on the traditional, blue-violet-sensitive photographic emulsions.

photometry - The measurement of light intensities.

photomultiplier - A photoelectric cell in which the electric current generated is amplified at several stages within the tube.

prime focus - The point in a telescope where the objective focuses the light.

prism - A wedge-shaped piece of glass that is used to disperse white light into a spectrum.

radio astronomy - The technique of making astronomical observations in radio wavelengths.

radio telescope - A telescope designed to make observations in radio wavelengths.

reflecting telescope - A telescope in which the principal optical component (objective) is a concave mirror.

refracting telescope - A telescope in which the principal optical component (objective) is a lens or system of lenses.

resolution - The degree to which fine details in an image are separated or resolved.

resolving power - A measure of the ability of an optical system to resolve or separate fine details in the image it produces; in astronomy, the angle in the sky that can be resolved by a telescope.

Schmidt telescope - A type of reflecting telescope invented by Bernhard Schmidt, in which certain aberrations produced by a spherical concave mirror are compensated for by a thin objective correcting lens.

science - The attempt to find order in nature or to find laws that describe natural phenomena.

spectral sequence - The sequence of spectral classes of stars arranged in order of decreasing temperatures of stars of those classes.

spectrograph - An instrument for photographing a spectrum; usually attached to a telescope to photograph the spectrum of a star.

spectroheliogram - A photograph of the sun obtained with a spectroheliograph.

spectrophotometry - The measurement of the intensity of light from a star or other source at different wavelengths.

spectroscope - An instrument for directly viewing the spectrum of light source.

spectroscopy - The study of spectra.

spectrum - The array of colors or wavelengths obtained when light from a source is dispersed, as in passing it through a prism or grating.

steady state (theory of cosmology) - A theory of cosmology which proposes that the universe has existed and will exist forever in its current form. The observed expansion of the universe being caused by the continuous creation of new matter so that the average density and appearance of the universe remains the same at all times.

theory - A set of hypotheses and laws that have been well demonstrated as applying to a wide range of phenomena associated with a particular subject.

thermal energy - Energy associated with the motions of the molecules in a substance.

thermal radiation - The radiation emitted by any body or gas that is not at absolute zero.

transit - An instrument for timing the exact instant a star or other objects crosses the local meridian. Also, the passage of a celestial body across the meridian; or the passage of a small body across the disk of a large one.

21-cm line - A spectral line of neutral hydrogen at the radio wavelength of 21 cm.

ultraviolet radiation - Electromagnetic radiation of wavelengths shorter than the shortest (violet) wavelengths to which the eye is sensitive; radiation of wavelengths in the approximate range 100 to 4000 angstroms.

universe - The totality of all matter and radiation and the space occupied by the same.

variable star - A star that varies in luminosity.

APPENDIX

offer and sale of commodity options is currently limited to member FCMs and their APs, as already noted, Rule 33.3(b) expressly allows non-member FCMs and their APs to engage in the offer and sale of commodity options if they are members of a registered futures association which regulates the option-related activities of its members in a manner equivalent to that required of contract markets under the Commission's rules. In this connection, the National Futures Association ("NFA") has submitted, pursuant to Section 17(j) of the Commodity Exchange Act, as amended, 7 U.S.C. 21(j)(1976), proposed compliance rules governing the solicitation and handling of option accounts by NFA-member FCMs and their sales personnel and option sales practice audit procedures. The Division staff is currently reviewing NFA's submission and anticipates completion of the review process shortly.⁴ At such time as NFA rules governing options and the requisite joint audit agreements are approved by the Commission, and NFA implements its program to regulate the option-related activities of its members in a manner equivalent to that required of contract markets under the Commission's rules, any person adversely affected by this decision will be able to solicit and accept option orders as an NFA member. Thus, the restrictions imposed by this determination may be expected to be mitigated in the near future.⁵

⁴The NFA proposal, however, also relies upon the execution of joint audit agreements between the NFA and those exchanges designated or applying for designation to trade options. Although those joint audit agreements must also be approved by the Commission before NFA's option program can become effective, NFA and the participant exchanges have not yet submitted the agreements for Commission review.

⁵Consistent with the Commission's prior interpretation of Rule 33.3, the Commission also notes that a member FCM may decide whether to accept option orders solicited and accepted by the APs of its agents (except by agents which are non-member FCMs or agents of such FCMs), so long as the rules of the relevant contract market permit. In this regard, the Commission wishes to reemphasize the obligations of a member FCM which makes an affirmative decision on this issue, as originally expressed at the time the final option rules were adopted. Specifically, an FCM must assume full responsibility for the acts of such agents and, in particular, must supervise the option sales practices of their APs. Further, a member FCM may not accept option orders from non-member FCMs or agents of non-member FCMs which were solicited and accepted in violation of Rule 33.3(b)(1), as interpreted by the Commission. Similarly, contract markets which have option sales practice audit programs are reminded that they have represented that they will carefully monitor participation by agents of member FCMs in the pilot program to ensure that their activities are conducted in conformity with the foregoing limitations and obligations.

Issued in Washington, D.C. on January 26, 1983, by the Commission.

Jane K. Stuckey,

Secretary of the Commission.

[FR Doc. 83-3882 Filed 2-1-83; 8:45 am]

BILLING CODE 6361-01-M

DEPARTMENT OF THE TREASURY

Internal Revenue Service

26 CFR Part 6a

[T.D. 7832]

Income Tax; Temporary Income Tax Regulations Under Subtitle C of Title XI of the Omnibus Reconciliation Act of 1980; Foreign Investment in United States Real Property

Correction

In FR Doc. 82-25829, beginning on page 41532, in the issue of Tuesday, September 21, 1982, on page 41536, in the first column, in the second line, "June 21, 1982." should read "June 21, 1983."

BILLING CODE 1505-01-M

DEPARTMENT OF THE INTERIOR

National Park Service

36 CFR Part 65

National Historic Landmarks Program

AGENCY: National Park Service, Interior.

ACTION: Final rule.

SUMMARY: These regulations set forth the Secretary of the Interior's criteria for national significance and the process used to identify, designate, recognize and monitor the integrity of National Historic Landmarks. This final rule incorporates revisions required by the National Historic Preservation Act Amendments of 1980 Pub. L. 96-515 ("Amendments"), and updates and revises in other minor respects the National Historic Landmark procedures based in part on comments received in response to publication of prior regulations. The regulations make available to Federal agencies, State and local governments, private organizations, and individuals information necessary for understanding of and participation in the National Historic Landmarks Program.

DATES: Final rule effective February 2, 1983.

FOR FURTHER INFORMATION CONTACT: Edwin C. Bearss, Chief, History Division (202) ~~343-8163~~ Address: Chief, History

343-8163

Division, National Park Service, P.O. Box 37127
Washington, DC 20013-7127

SUPPLEMENTARY INFORMATION: The National Historic Landmarks Program, administered by the National Park Service, is the program of the Department of the Interior for identifying, designating, recognizing, listing, and monitoring National Historic Landmarks. Two offices in the national Park Service cooperate in managing the program: the Office of the Associate Director, Cultural Resources Management; through the History Division, manages the functions of identifying, designating and recognizing landmarks; the Office of the Associate Director for National Register Programs lists landmarks on the National Register of Historic Places and monitors their condition. The program provides limited protection to historic properties and assists the planning needs of Federal, State and local agencies and private organizations and individuals because it is the primary Federal means of assessing the national level of significance of historic properties, including those proposed for inclusion in the National Park System and for addition to the World Heritage List. Authority for the National Historic Landmarks Program is derived from the historic Sites Act of 1935 (49 Stat. 666, 16 U.S.C. 461 *et seq.*), which established a national policy to preserve "historic sites, buildings, and objects of national significance," and the National Historic Preservation Act Amendments of 1980 (Amendments).

Interim rules for the National Historic Landmarks Program were published in the *Federal Register* on December 18, 1979, 44 FR 74826, with a request for comments. The December 18, 1979 interim rules are replaced by the final rules published today. Responses to the publication of the December 18, 1979 interim rules indicate the wide range of parties participating in the Landmarks Program, including State Historic Preservation Officers, other State and Federal agencies, university faculties, business firms, private organizations and individuals. On December 12, 1980, the Amendments became law necessitating revisions in the National Historic Landmark designation process. The Amendments require the Secretary of the Interior to promulgate or revise regulations for the following:

(a) Establishing and revising criteria for National Historic Landmarks;

(b) Designating properties as National Historic Landmarks and removing such designations;

(c) Considering appeals from such nominations, removals, and designations (or any failure or refusal by a nominating authority to nominate or designate);

(d) Notifying the owner of a property, appropriate local governments and the general public, when the property is being considered for designation as a National Historic Landmark;

(e) Notifying the owners of private property and providing them an opportunity (including a reasonable period of time) to concur in or object to the nomination of the property or district for designation;

(f) Reviewing the nomination of the property or district where any such objection has been made, determining whether or not the property or district is eligible for designation, and informing the Advisory Council on Historic Preservation, the appropriate State official, the appropriate chief elected local official and the owner or owners of such property of the Secretary's determination; and,

(g) In the case of National Historic Landmark districts for which no boundaries have been established, publishing proposed boundaries in the *Federal Register* and submitting them to the Committee on Energy and Natural Resources of the United States Senate and to the Committee on Interior and Insular Affairs of the United States House of Representatives.

The Amendments require the Secretary to send any proposed regulations published thereunder to the Committee on Interior and Insular Affairs of the House of Representatives and the Committee on Energy and Natural Resources of the Senate before publication in the *Federal Register* for comment, and to send final regulations to Congress before publication.

In addition to the changes required by the Amendments, these final regulations reflect comments made in response to the December 18, 1979 interim regulations. Since the issuance of the December 18, 1979 interim regulations, the Heritage Conservation and Recreation Service (HCRS) has been abolished and the National Historic Landmarks Program transferred to the National Park Service (NPS). Comments received often refer to the Consulting Committee which was a review board proposed to examine and make professional recommendations to the Director (HCRS) and the Secretary of the Interior regarding the qualifications of nominated National Historic Landmarks. With the transfer of the program to the National Park Service, these regulations substitute the National

Park System Advisory Board for the Consulting Committee.

Summary of comments and response to comments on the December 18, 1979 interim regulations:

One State urged that a specific system be established for nominations by State Historic Preservation Officers. The National Park Service also emphasized that National Historic Landmarks should be selected primarily on the basis of theme studies because of the importance of comparative analysis. Both of these concerns are incorporated into the priorities for selecting studies established in these regulations.

Several comments were received concerning the composition of the Consulting Committee and the role of the Committee. One comment suggested that designation by the Secretary without Consulting Committee review should be provisional and should require Committee concurrence within a specified period of time. Another comment recommended that the Committee include expertise in both historic and prehistoric archeology. As a result, the regulations have been made more specific concerning when and how the Secretary may designate National Historic Landmarks without National Park System Advisory Board review.

Several private companies expressed concerns about the effects of designation. One company interpreted the Historic Sites Act to mean that the Department of the Interior must obtain an interest in a property before designation. The Department does not agree with this interpretation of the act. The same company expressed concern that the owners were giving up some right in their property. Under Federal law, National Historic Landmark designation of a private property does not prohibit any actions which may otherwise be taken by the owner with respect to the property.

Others suggested that the role of the Director in the designation process should be clarified. This has been done in the regulations. One comment also urged that NPS should assure that all National Historic Landmark studies, public meetings, etc., should be carried out by NPS or with an NPS representative present. While this concern is not addressed in the regulations, NPS will assure that there is adequate NPS oversight of all aspects of the program.

One comment expressed concern that some aspects of the National Historic Landmark criteria are too broad, for example, the references to movements, ideals, beliefs and phenomena. The regulations make clear that the criteria are the general standards for evaluation

of national significance; however, NPS emphasizes that the significance of each property must be evaluated on the basis of a thorough and detailed scholarly study.

The notification procedures before designation were the subject of a number of comments. One State Historic Preservation Officer recommended that State Historic Preservation Officers always participate in public meetings. Although this is not addressed in the regulations, NPS always welcomes State Historic Preservation Officers' participation in public meetings as well as in other aspects of the program.

Other comments recommended that additional parties be notified, as well as those included in the interim regulations. Because notice is costly, NPS can routinely notify only a certain number of parties as part of the nomination process.

A number of comments recommended revising the registration section. Some comments recommended that certificates be presented to all National Historic Landmarks. This has been included. Others recommended that plaques not be presented unless the recipients are willing to publicly display them. This has been included. Another comment questioned getting owners to sign a preservation agreement which is not binding. Based on these comments the registration aspect of the program has been substantially revised.

To fulfill the requirements of the Amendments and on the basis of the comments received on the December 18, 1979 interim regulations, substantive revisions have been made in the sections of the regulations listed below:

Section 65.2. A new section on the effects of designation has been added.

Section 65.4. The National Historic Landmark Criteria, Section 1205.9 in the December 18, 1979 interim rules (reprinted as 36 CFR Part 65 in 1981 to reflect the reorganization of HCRS into NPS) have been moved to a new position to emphasize their importance as the basis for all decisions on landmark designation. These criteria were revised following consultation with historical and archeological associations, the History Areas Committee of the National Park System Advisory Board and the National Register. As a result, the revised criteria herein have been substituted for those of the 1979 rules. With some changes, these are the criteria used by the National Historic Landmarks Program before the 1979 rules. They are less cumbersome and more closely parallel with the criteria of the National Register (36 CFR Part 60).

Section 65.5. New language has been inserted to clarify the method and priorities used to identify prospective landmarks, to assure general understanding of how National Historic Landmark studies are scheduled, and to define the role of the appropriate State officials, Federal agencies and other parties in that process.

The Department receives numerous requests to designate properties as National Historic Landmarks from State officials, property owners and others. The requests to study and designate such properties far exceed the funds and staff available to the Department for the conduct of the program. National Historic Landmarks will, with rare exceptions, be identified on the basis of theme studies which provide the contextual framework to evaluate the relative significance of properties. The theme studies, which organize the study of American history, and special studies for properties not in active theme studies will be conducted according to priorities established herein.

State and Federal agencies evaluate, document, and nominate significant historic properties to the National Register of Historic Places, under the authorities of the National Historic Preservation Act of 1966, as amended, and Executive Order 11593. Their efforts are one basis for establishing National Historic Landmark Program priorities and assist in avoiding duplication of effort.

Section 65.5(c)(2). This paragraph has been modified to state that onsite visits will be required unless NPS determines such a visit is not necessary and to indicate that NPS may conduct a public information meeting for properties with more than 50 owners and will do so for such a property upon request by the chief elected official of the local, county or municipal political jurisdiction in which the property is located. This section also provides that properties on which the onsite visit was conducted before the effective date of these regulations are not subject to the notice provisions announcing that a study is being conducted.

Section 65.5(c)(4). New language has been added to identify minimum requirements for the study report or nomination for each prospective landmark.

Section 65.5(d)(5). This paragraph has been modified to provide owners an opportunity to concur in or object to designation and to specify how a statement of objection shall be transmitted to NPS.

Section 65.5(e)(2). New language has been added to provide that studies submitted to the Consulting Committee

or National Park System Advisory Board before the effective date of these regulations need not be resubmitted to the National Park System Advisory Board. In such instances, if a property appears to qualify for designation, NPS will provide at least 30 days notice, a copy of the study report, and an opportunity to comment, and, for owners, an opportunity to concur in or object to the designation as specified in § 65.5(d) (2) and (3), before submitting a property to the Secretary for designation.

Section 65.5(e)(3). New language has been added to clarify the role of the Director in the evaluation and designation of landmarks.

Section 65.5(f). New language has been added to provide that if the owners of private property or for a district the majority of such owners have objected to the designation, the Secretary shall make a determination of a property's eligibility for National Historic Landmark designation, as required by the Amendments. The paragraph also establishes that the Keeper may list in the National Register properties considered for National Historic Landmark designation which do not meet the National Historic Landmark criteria but do meet the National Register criteria for State or local significance or determine such properties eligible for listing if the private owners or a majority of such owners object to listing.

Section 65.5(g). This paragraph describes the notices which NPS will provide concerning designations, determinations of eligibility for designation or other actions taken by the Secretary.

Section 65.5(h). New language has been added to clarify when the Secretary may designate National Historic Landmarks without review by the National Park System Advisory Board and to identify notification procedures and other procedural steps to be followed in the designation of landmarks without Advisory Board review.

Section 65.8. Landmark Registration has been redefined as Landmark Recognition; this change will eliminate potential confusion between "Registered" Landmarks and National Register properties.

Section 65.8(d)(1). A new provision is added that in the case of National Historic Landmark districts for which no boundaries have been established, proposed boundaries shall be published in the Federal Register for comment and submitted to the Committee on Energy and Natural Resources of the United States Senate and the Committee on

Interior and Insular Affairs of the United States House of Representatives to allow not less than 30 nor more than 60 days to comment on the proposed boundaries.

Section 65.9(a). New language expands the potential justification for withdrawals of landmark designation from three to four, including alternation of kind or degree of significance because of previously undiscovered information and reevaluation of the theme under which the designation was originally granted.

Section 65.9(b). This section specifies that properties designated as National Historic Landmarks before enactment of the Amendments, December 13, 1980, can only be redesignated if they have ceased to meet the criteria for designation because the qualities which caused them to be originally designated have been lost or destroyed. This provision is consistent with the Amendments' "grandfathering" all historic properties listed as National Historic Landmarks in the Federal Register of February 8, 1979 or thereafter prior to the effective date of the Amendments, and with the Congressional committee reports on the Amendments which recognize that the Secretary may dedesignate properties which have lost the historic qualities for which they were designated.

Section 65.9(c). A process is established for appeals for dedesignation.

Section 65.9(e). New language provides for possible continued National Register listing when a landmark designation is withdrawn and automatic National Register eligibility when designation is withdrawn because of procedural error.

Section 65.10. A new section has been added which establishes a formal process for appealing decisions not to designate a property a National Historic Landmark.

These substantive revisions are accompanied by minor changes in language throughout the regulations for purposes of clarity and consistency. The Department of the Interior emphasizes that the National Historic Landmark criteria constitute the standards against which all prospective landmarks are measured. These criteria do not contain a specific definition of significance. Instead, they are purposely worded to create a qualitative framework that can be applied to the wide variety of properties of national significance. The basis for designation of properties as landmarks is a scholarly, professional analysis of the historical documentation for each property and of the property's

relative significance within a major field or theme of American history or prehistory.

The Department of the Interior has given particular attention to the need for expanded public participation in the National Historic Landmark designation process. Notification requirements have been set which will insure that property owners, appropriate State officials, local governments, Members of Congress, and other interested parties will have ample opportunity to participate in the National Historic Landmarks Program.

Authority: This rulemaking is developed under the authority of the Historic Sites Act of 1935, 16 U.S.C. 461 *et seq.*, and the National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 *et seq.*

The Department of the Interior has determined that this document is not a major rule under Executive Order 12291 and does not have a significant economic effect on a substantial number of small entities in accordance with the Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*). These revisions are procedural, not substantive. They tell the public how properties are nominated for designation as National Historic Landmarks and because they are procedural only they have no significant economic effect on small entities.

Paperwork Reduction Act

This rule does not contain information collection requirements which require approval by the Office of Management and Budget under 44 U.S.C 3501 *et seq.*

Since this rule has to do only with the procedural aspects of the National Historic Landmarks Program and does not constitute a major Federal action significantly affecting the quality of the human environment under the National Environmental Policy Act of 1969 an environmental impact statement is not required.

List of Subjects in 36 CFR Part 65

Historic preservation.

The originator of these procedures is Benjamin Levy, History Division, National Park Service.

Dated: October 19, 1982.

Ric Davidge,
Acting Assistant Secretary, Fish and Wildlife and Parks.

(16 U.S.C. 461 *et seq.*; 16 U.S.C. 470 *et seq.*)

Accordingly 36 CFR Part 65 is revised to read as follows:

PART 65—NATIONAL HISTORIC LANDMARKS PROGRAM

- Sec.
- 65.1 Purpose and authority.
- 65.2 Effects of designation.

- Sec.
- 65.3 Definitions.
- 65.4 National Historic Landmark Criteria.
- 65.5 Designation of National Historic Landmarks.
- 65.6 Recognition of National Historic Landmarks.
- 65.7 Monitoring National Historic Landmarks.
- 65.8 Alteration of National Historic Landmark Boundaries.
- 65.9 Withdrawal of National Historic Landmark Designation.
- 65.10 Appeals for designation.

Authority: 16 U.S.C. 461 *et seq.*, 16 U.S.C. 470 *et seq.*

§ 65.1 Purpose and authority.

The purpose of the National Historic Landmarks Program is to identify and designate National Historic Landmarks, and encourage the long range preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the United States. These regulations set forth the criteria for establishing national significance and the procedures used by the Department of the Interior for conducting the National Historic Landmarks Program.

(a) In the Historic Sites Act of 1935 (45 Stat. 666, 16 U.S.C. 461 *et seq.*) the Congress declared that it is a national policy to preserve for public use historic sites, buildings and objects of national significance for the inspiration and benefit of the people of the United States and:

(b) To implement the policy, the Act authorizes the Secretary of the Interior to perform the following duties and functions, among others:

(1) To make a survey of historic and archeological sites, buildings and objects for the purpose of determining which possess exceptional value as commemorating or illustrating the history of the United States;

(2) To make necessary investigations and researches in the United States relating to particular sites, buildings or objects to obtain true and accurate historical and archeological facts and information concerning the same; and

(3) To erect and maintain tablets to mark or commemorate historic or prehistoric places and events of national historical or archeological significance.

(c) The National Park Service (NPS) administers the National Historic Landmarks Program on behalf of the Secretary.

§ 65.2 Effects of designation.

(a) The purpose of the National Historic Landmarks Program is to focus attention on properties of exceptional value to the nation as a whole rather than to a particular State or locality. The program recognizes and promotes the

preservation efforts of Federal, State and local agencies, as well as of private organizations and individuals and encourages the owners of landmark properties to observe preservation precepts.

(b) Properties designated as National Historic Landmarks are listed in the National Register of Historic Places upon designation as National Historic Landmarks. Listing of private property on the National Register does not prohibit under Federal law or regulations any actions which may otherwise be taken by the property owner with respect to the property.

(c) Specific effects of designation are:

(1) The National Register was designed to be and is administered as a planning tool. Federal agencies undertaking a project having an effect on a listed or eligible property must provide the Advisory Council on Historic Preservation a reasonable opportunity to comment pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended. The Advisory Council has adopted procedures concerning, *inter alia*, their commenting responsibility in 36 CFR Part 800.

(2) Section 110(f) of the National Historic Preservation Act of 1966, as amended, requires that before approval of any Federal undertaking which may directly and adversely affect any National Historic Landmark, the head of the responsible Federal agency shall, to the maximum extent possible, undertake such planning and actions as may be necessary to minimize harm to such landmark, and shall afford the Advisory Council a reasonable opportunity to comment on the undertaking.

(3) Listing in the National Register makes property owners eligible to be considered for Federal grants-in-aid and loan guarantees (when implemented) for historic preservation.

(4) If a property is listed in the National Register, certain special Federal income tax provisions may apply to the owners of the property pursuant to Section 2124 of the Tax Reform Act of 1976, the Economic Recovery Tax Act of 1981 and the Tax Treatment Extension Act of 1980.

(5) If a property contains surface coal resources and is listed in the National Register, certain provisions of the Surface Mining and Control Act of 1977 require consideration of a property's historic values in determining issuance of a surface coal mining permit.

(6) Section 8 of the National Park System General Authorities Act of 1970, as amended (90 Stat. 1940, 16 U.S.C. 1-5), directs the Secretary to prepare an

annual report to Congress which identifies all National Historic Landmarks that exhibit known or anticipated damage or threats to the integrity of their resources. In addition, National Historic Landmarks may be studied by NPS for possible recommendation to Congress for inclusion in the National Park System.

(7) Section 9 of the Mining in the National Parks Act of 1976 (90 Stat. 1342, 16 U.S.C. 1980) directs the Secretary of the Interior to submit to the Advisory Council a report on any surface mining activity which the Secretary has determined may destroy a National Historic Landmark in whole or in part, and to request the advisory Council's advice on alternative measures to mitigate or abate such activity.

§ 65.3 Definitions.

As used in this rule:

(a) "Advisory Council" means the Advisory Council on Historic Preservation, established by the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470 *et seq.*). Address: Executive Director, Advisory Council on Historic Preservation, 1522 K Street NW, Washington, DC 20005.

(b) "Chief elected local official" means the mayor, county judge or otherwise titled chief elected administrative official who is the elected head of the local political jurisdiction in which the property is located.

(c) "Advisory Board" means the National Park System Advisory Board which is a body of authorities in several fields of knowledge appointed by the Secretary under authority of the Historic Sites Act of 1935, as amended.

(d) "Director" means Director, National Park Service.

(e) "District" means a geographically definable area, urban or rural, that possesses a significant concentration, linkage or continuity of sites, buildings, structures or objects united by past events or aesthetically by plan or physical development. A district may also comprise individual elements separated geographically but linked by association or history.

(f) "Endangered property" means a historic property which is or is about to be subjected to a major impact that will destroy or seriously damage the resources which make it eligible for National Historic Landmark designation.

(g) "Federal Preservation Officer" means the official designated by the head of each Federal agency responsible for coordinating that agency's activities under the National Historic Preservation Act of 1966, as amended, including nominating properties under that

agency's ownership or control to the National Register.

(h) "Keeper" means the Keeper of the National Register of Historic Places.

(i) "Landmark" means National Historic Landmark and is a district, site, building, structure or object, in public or private ownership, judged by the Secretary to possess national significance in American history, archeology, architecture, engineering and culture, and so designated by him.

(j) "National Register" means the National Register of Historic Places, which is a register of districts, sites, buildings, structures and objects significant in American history, architecture, archeology, engineering and culture, maintained by the Secretary. (Section 2(b) of the Historic Sites Act of 1935 (49 Stat. 866, 16 U.S.C. 461) and Section 101(a)(1) of the National Historic Preservation Act of 1966 (80 Stat. 915; 16 U.S.C. 470), as amended.) (Address: Chief, Interagency Resource Management Division, 440 G Street NW, Washington, DC 20243.)

(k) "National Historic Landmarks Program" means the program which identifies, designates, recognizes, lists, and monitors National Historic Landmarks conducted by the Secretary through the National Park Service. (Address: Chief, History Division, National Park Service, Washington, DC 20240; addresses of other participating divisions found throughout these regulations.)

(l) "Object" means a material thing of functional, aesthetic, cultural, historical or scientific value that may be, by nature or design, movable yet related to a specific setting or environment.

(m) "Owner" or "owners" means those individuals, partnerships, corporations or public agencies holding fee simple title to property. "Owner" or "owners" does not include individuals, partnerships, corporations or public agencies holding easements or less than fee interests (including leaseholds) of any nature.

(n) "Property" means a site, building, object, structure or a collection of the above which form a district.

(o) "Secretary" means the Secretary of the Interior.

(p) "Site" means the location of a significant event, a prehistoric or historic occupation or activity, or a building or structure, whether standing, ruined or vanished, where the location itself maintains historical or archeological value regardless of the value of any existing structure.

(q) "State official" means the person who has been designated in each State to administer the State Historic Preservation Program.

(r) "Structure" means a work made by human beings and composed of interdependent and interrelated parts in a definite pattern of organization.

§ 65.4 National Historic Landmark criteria.

The criteria applied to evaluate properties for possible designation as National Historic Landmarks or possible determination of eligibility for National Historic Landmark designation are listed below. These criteria shall be used by NPS in the preparation, review and evaluation of National Historic Landmark studies. They shall be used by the Advisory Board in reviewing National Historic Landmark studies and preparing recommendations to the Secretary. Properties shall be designated National Historic Landmarks only if they are nationally significant. Although assessments of national significance should reflect both public perceptions and professional judgments, the evaluations of properties being considered for landmark designation are undertaken by professionals, including historians, architectural historians, archeologists and anthropologists familiar with the broad range of the nation's resources and historical themes. The criteria applied by these specialists to potential landmarks do not define significance nor set a rigid standard for quality. Rather, the criteria establish the qualitative framework in which a comparative professional analysis of national significance can occur. The final decision on whether a property possesses national significance is made by the Secretary on the basis of documentation including the comments and recommendations of the public who participate in the designation process.

(a) Specific Criteria of National Significance: The quality of national significance is ascribed to districts, sites, buildings, structures and objects that possess exceptional value or quality in illustrating or interpreting the heritage of the United States in history, architecture, archeology, engineering and culture and that possess a high degree of integrity of location, design, setting, materials, workmanship, feeling and association, and:

(1) That are associated with events that have made a significant contribution to, and are identified with, or that outstandingly represent, the broad national patterns of United States history and from which an understanding and appreciation of those patterns may be gained; or

(2) That are associated importantly with the lives of persons nationally significant in the history of the United States; or

(3) That represent some great idea or ideal of the American people; or

(4) That embody the distinguishing characteristics of an architectural type specimen exceptionally valuable for a study of a period, style or method of construction, or that represent a significant, distinctive and exceptional entity whose components may lack individual distinction; or

(5) That are composed of integral parts of the environment not sufficiently significant by reason of historical association or artistic merit to warrant individual recognition but collectively compose an entity of exceptional historical or artistic significance, or outstandingly commemorate or illustrate a way of life or culture; or

(6) That have yielded or may be likely to yield information of major scientific importance by revealing new cultures, or by shedding light upon periods of occupation over large areas of the United States. Such sites are those which have yielded, or which may reasonably be expected to yield, data affecting theories, concepts and ideas to a major degree.

(b) Ordinarily, cemeteries, birthplaces, graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings and properties that have achieved significance within the past 50 years are not eligible for designation. Such properties, however, will qualify if they fall within the following categories:

(1) A religious property deriving its primary national significance from architectural or artistic distinction or historical importance; or

(2) A building or structure removed from its original location but which is nationally significant primarily for its architectural merit, or for association with persons or events of transcendent importance in the nation's history and the association consequential; or

(3) A site of a building or structure no longer standing but the person or event associated with it is of transcendent importance in the nation's history and the association consequential; or

(4) A birthplace, grave or burial if it is of a historical figure of transcendent national significance and no other appropriate site, building or structure directly associated with the productive life of that person exists; or

(5) A cemetery that derives its primary national significance from graves of persons of transcendent importance, or from an exceptionally distinctive design or from an exceptionally significant event; or

(6) A reconstructed building or ensemble of buildings of extraordinary national significance when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other buildings or structures with the same association have survived; or

(7) A property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own national historical significance; or

(8) A property achieving national significance within the past 50 years if it is of extraordinary national importance.

§ 65.5 Designation of National Historic Landmarks.

Potential National Historic Landmarks are identified primarily by means of theme studies and in some instances by special studies. Nominations and recommendations made by the appropriate State officials, Federal Preservation Officers and other interested parties will be considered in scheduling and conducting studies.

(a) *Theme studies.* NPS defines and systematically conducts organized theme studies which encompass the major aspects of American history. The theme studies provide a contextual framework to evaluate the relative significance of historic properties and determine which properties meet National Historic Landmark criteria. Theme studies will be announced in advance through direct notice to appropriate State officials, Federal Preservation Officers and other interested parties and by notice in the Federal Register. Within the established thematic framework, NPS will schedule and conduct National Historic Landmark theme studies according to the following priorities. Themes which meet more of these priorities ordinarily will be studied before those which meet fewer of the priorities:

(1) Theme studies not yet begun as identified in "History and Prehistory in the National Park System," 1982.

(2) Theme studies in serious need of revision.

(3) Theme studies which relate to a significant number of properties listed in the National Register bearing opinions of State Historic Preservation Officers and Federal Preservation Officers that such properties are of potential national significance. (Only those recommendations which NPS determines are likely to meet the landmarks criteria will be enumerated in determining whether a significant number exists in a theme study.)

(4) Themes which reflect the broad planning needs of NPS and other

Federal agencies and for which the funds to conduct the study are made available from sources other than the regularly programmed funds of the National Historic Landmarks Program.

(b) *Special Studies.* NPS will conduct special studies for historic properties outside of active theme studies according to the following priorities:

(1) Studies authorized by Congress or mandated by Executive Order will receive the highest priority.

(2) Properties which NPS determines are endangered and potentially meet the National Historic Landmarks criteria, whether or not the theme in which they are significant has been studied.

(3) Properties listed in the National Register bearing State or Federal agency recommendations of potential national significance where NPS concurs in the evaluation and the property is significant in a theme already studied.

(c)(1) When a property is selected for study to determine its potential for designation as a National Historic Landmark, NPS will notify in writing, except as provided below, (i) the owner(s), (ii) the chief elected local official, (iii) the appropriate State official, (iv) the Members of Congress who represent the district and State in which the property is located, and, (v) if the property is on an Indian reservation, the chief executive officer of the Indian tribe, that it will be studied to determine its potential for designation as a National Historic Landmark. This notice will provide information on the National Historic Landmarks Program, the designation process and the effects of designation.

(2) When the property has more than 50 owners, NPS will notify in writing (i) the chief elected local official, (ii) the appropriate State official, (iii) the Members of Congress who represent the district and State in which the property is located, and, (iv) if the property is on an Indian reservation, the chief executive officer of the Indian tribe, and (v) provide general notice to the property owners. This general notice will be published in one or more local newspapers of general circulation in the area in which the potential National Historic Landmark is located and will provide information on the National Historic Landmarks Program, the designation process and the effects of designation. The researcher will visit each property selected for study unless it is determined that an onsite investigation is not necessary. In the case of districts with more than 50 owners NPS may conduct a public information meeting if widespread

public interest so warrants or on request by the chief elected local official.

(3) Properties for which a study was conducted before the effective date of these regulations are not subject to the requirements of paragraph (c) (1) and (2) of this section.

(4) The results of each study will be incorporated into a report which will contain at least (i) a precise description of the property studied; and (ii) an analysis of the significance of the property and its relationship to the National Historic Landmark criteria.

(d)(1) Properties appearing to qualify for designation as National Historic Landmarks will be presented to the Advisory Board for evaluation except as specified in subsection (h) of this section.

(2) Before the Advisory Board's review of a property, NPS will provide written notice of this review, except as provided below, and a copy of the study report to (i) the owner(s) of record; (ii) the appropriate State official; (iii) the chief elected local official; (iv) the Members of Congress who represent the district and State in which the property is located; and, (v) if the property is located on an Indian reservation, the chief executive officer of the Indian tribe. The list of owners shall be obtained from official land or tax record, whichever is most appropriate, within 90 days prior to the notification of intent to submit to the Advisory Board. If in any State the land or tax record is not the appropriate list an alternative source of owners may be used. NPS is responsible for notifying only those owners whose names appear on the list. Where there is more than one owner on the list each separate owner shall be notified.

(3) In the case of a property with more than 50 owners, NPS will notify, in writing, (i) the appropriate State official; (ii) the chief elected local official; (iii) the Members of Congress who represent the district and State in which the property is located; (iv) if the property is located on an Indian reservation, the chief executive officer of the Indian tribe; and, (v) will provide general notice to the property owners. The general notice will be published in one or more local newspapers of general circulation in the area in which the property is located. A copy of the study report will be made available on request. Notice of Advisory Board review will also be published in the Federal Register.

(4) Notice of Advisory Board review will be given at least 60 days in advance of the Advisory Board meeting. The notice will state date, time and location of the meeting; solicit written comments and recommendations on the study

report; provide information on the National Historic Landmarks Program, the designation process and the effects of designation and provide the owners of private property not more than 60 days in which to concur in or object in writing to the designation. Notice of Advisory Board meetings and the agenda will also be published in the Federal Register. Interested parties are encouraged to submit written comments and recommendations which will be presented to the Advisory Board. Interested parties may also attend the Advisory Board meeting and upon request will be given an opportunity to address the Board concerning a property's significance, integrity and proposed boundaries.

(5) Upon notification, any owner of private property who wishes to object shall submit to the Chief, History Division, a notarized statement that the party is the sole or partial owner of record of the property, as appropriate, and objects to the designations. Such notice shall be submitted during the 60-day commenting period. Upon receipt of notarized objections respecting a district or an individual property with multiple ownership it is the responsibility of NPS to ascertain whether a majority of owners have so objected. If an owner whose name did not appear on the list certifies in a written notarized statement that the party is the sole or partial owner of a nominated private property such owner shall be counted by NPS in determining whether a majority of owners has objected. Each owner of private property in a district has one vote regardless of how many properties or what part of one property that party owns and regardless of whether the property contributes to the significance of the district.

(6) The commenting period following notification can be waived only when all property owners and the chief elected local official have agreed in writing to the waiver.

(e)(1) The Advisory Board evaluates such factors as a property's significance, integrity, proposed boundaries and the professional adequacy of the study. If the Board finds that these conditions are met, it may recommend to the Secretary that a property be designated or declared eligible for designation as a National Historic Landmark. If one or more of the conditions are not met, the Board may recommend that the property not be designated a landmark or that consideration of it be deferred for further study, as appropriate. In making its recommendation, the Board shall state, if possible, whether or not it finds that the criteria of the landmarks program have been met. A simple

majority is required to make a recommendation of designation. The Board's recommendations are advisory.

(2) Studies submitted to the Advisory Board (or the Consulting Committee previously under the Heritage Conservation and Recreation Service) before the effective date of these regulations need not be resubmitted to the Advisory Board. In such instances, if a property appears to qualify for designation, NPS will provide notice and a copy of the study report to the parties as specified in subsections (d)(2) and (3) of this section and will provide at least 30 days in which to submit written comments and to provide an opportunity for owners to concur in or object to the designation.

(3) The Director reviews the study report and the Advisory Board recommendations, certifies that the procedural requirements set forth in this section have been met and transmits the study reports, the recommendations of the Advisory Board, his recommendations and any other recommendations and comments received pertaining to the properties to the Secretary.

(f) The Secretary reviews the nominations, recommendations and any comments and, based on the criteria set forth herein, makes a decision on National Historic Landmark designation. Properties that are designated National Historic Landmarks are entered in the National Register of Historic Places, if not already so listed.

(1) If the private owner or, with respect to districts or individual properties with multiple ownership, the majority of such owners have objected to the designation by notarized statements, the Secretary shall not make a National Historic Landmark designation but shall review the nomination and make a determination of its eligibility for National Historic Landmark designation.

(2) The Secretary may thereafter designate such properties as National Historic Landmarks only upon receipt of notarized statements from the private owner (or majority of private owners in the event of a district or a single property with multiple ownership) that they do not object to the designation.

(3) The Keeper may list in the National Register properties considered for National Historic Landmark designation which do not meet the National Historic Landmark criteria but which do meet the National Register criteria for evaluation in 36 CFR Part 60 or determine such properties eligible for the National Register if the private owners or majority of such owners in

the case of districts object to designation. A property determined eligible for National Historic Landmark designation is determined eligible for the National Register.

(g) Notice of National Historic Landmark designation, National Register listing, or a determination of eligibility will be sent in the same manner as specified in subsections (d)(2) and (3) of this section. For properties which are determined eligible the Advisory Council will also be notified. Notice will be published in the Federal Register.

(h)(1) The Secretary may designate a National Historic Landmark without Advisory Board review through accelerated procedures described in this section when necessary to assist in the preservation of a nationally significant property endangered by a threat of imminent damage or destruction.

(2) NPS will conduct the study and prepare a study report as described in subsection (c)(4) of this section.

(3) If a property appears to qualify for designation, the National Park Service will provide notice and a copy of the study report to the parties specified in subsections (d)(2) and (3) and will allow at least 30 days for the submittal of written comments and to provide owners of private property an opportunity to concur in or object to designation as provided in subsection (d)(5) of this section except that the commenting period may be less than 60 days.

(4) The Director will review the study report and any comments, will certify that procedural requirements have been met, and will transmit the study report, his and any other recommendations and comments pertaining to the property to the Secretary.

(5) The Secretary will review the nomination and recommendations and any comments and, based on the criteria set forth herein, make a decision on National Historic Landmark designation or a determination of eligibility for designation if the private owners or a majority of such owners of historic districts object.

(6) Notice of National Historic Landmark designation or a determination of eligibility will be sent to the same parties specified in subsections (d)(2) and (3) of this section.

§ 65.6 Recognition of National Historic Landmarks.

(a) Following designation of a property by the Secretary as a National Historic Landmark, the owner(s) will receive a certificate of designation. In the case of a district, the certificate will be delivered to the chief elected local

official or other local official, or to the chief officer of a private organization involved with the preservation of the district, or the chief officer of an organization representing the owners of the district, as appropriate.

(b) NPS will invite the owner of each designated National Historic Landmark to accept, free of charge, a landmark plaque. In the case of a district, the chief elected local official or other local official; or the chief officer of an organization involved in the preservation of the district, or chief officer of an organization representing the owners of the district, as appropriate, may accept the plaque on behalf of the owners. A plaque will be presented to properties where the appropriate recipient(s) (from those listed above) agrees to display it publicly and appropriately.

(c) The appropriate recipient(s) may accept the plaque at any time after designation of the National Historic Landmark. In so doing owners give up none of the rights and privileges of ownership or use of the landmark property nor does the Department of the Interior acquire any interest in property so designated.

(d) NPS will provide one standard certificate and plaque for each designated National Historic Landmark. The certificate and plaque remain the property of NPS. Should the National Historic Landmark designation at any time be withdrawn, in accordance with the procedures specified in § 65.9 of these rules, or should the certificate and plaque not be publicly or appropriately displayed, the certificate and the plaque, if issued, will be reclaimed by NPS.

(e) Upon request, and if feasible, NPS will help arrange and participate in a presentation ceremony.

§ 65.7 Monitoring National Historic Landmarks.

(a) NPS maintains a continuing relationship with the owners of National Historic Landmarks. Periodic visits, contacts with State Historic Preservation Officers, and other appropriate means will be used to determine whether landmarks retain their integrity, to advise owners concerning accepted preservation standards and techniques and to update administrative records on the properties.

(b) Reports of monitoring activities form the basis for the annual report submitted to Congress by the Secretary of the Interior, as mandated by Section 8, National Park System General Authorities Act of 1970, as amended (90 Stat. 1940, 16 U.S.C. 1a-5). The Secretary's annual report will identify those National Historic Landmarks

which exhibit known or anticipated damage or threats to their integrity. In evaluating National Historic Landmarks for listing in the report, the seriousness and imminence of the damage or threat are considered, as well as the integrity of the landmark at the time of designation taking into account the criteria in Section 65.4.

(c) As mandated in Section 9, Mining in the National Parks Act of 1976 (90 Stat. 1342, 16 U.S.C. 1960), whenever the Secretary of the Interior finds that a National Historic Landmark may be irreparably lost or destroyed in whole or in part by any surface mining activity, including exploration for, removal or production of minerals or materials, the Secretary shall (1) notify the person conducting such activity of that finding; (2) submit a report thereon, including the basis for his finding that such activity may cause irreparable loss or destruction of a National Historic Landmark, to the Advisory Council; and (3) request from the Council advice as to alternative measures that may be taken by the United States to mitigate or abate such activity.

(d) Monitoring activities described in this section, including the preparation of the mandated reports to Congress and the Advisory Council are carried out by NPS regional offices under the direction of the Preservation Assistance Division, NPS [Address: Chief, Resource Assistance Division, National Park Service, 440 G Street NW, Washington, DC 20243] in consultation with the History Division, NPS.

§ 65.8 Alteration of National Historic Landmark boundaries.

(a) *Two justifications exist for enlarging the boundary of a National Historic Landmark:* Documentation of previously unrecognized significance or professional error in the original designation. Enlargement of a boundary will be approved only when the area proposed for addition to the National Historic Landmark possesses or contributes directly to the characteristics for which the landmark was designated.

(b) *Two justifications exist for reducing the boundary of a National Historic Landmark:* Loss of integrity or professional error in the original designation. Reduction of a boundary will be approved only when the area to be deleted from the National Historic Landmark does not possess or has lost the characteristics for which the landmark was designated.

(c) A proposal for enlargement or reduction of a National Historic Landmark boundary may be submitted

to or can originate with the History Division, NPS. NPS may restudy the National Historic Landmark and subsequently make a proposal, if appropriate, in the same manner as specified in § 65.5 (c) through (h). In the case of boundary enlargements only those owners in the newly nominated but as yet undesignated area will be notified and will be counted in determining whether a majority of private owners object to listing.

(d)(1) When a boundary is proposed for a National Historic Landmark for which no specific boundary was identified at the time of designation, NPS shall provide notice, in writing, of the proposed boundary to (i) the owner(s); (ii) the appropriate State official; (iii) the chief elected local official; (iv) the Members of Congress who represent the district and State in which the landmark is located, and (v) if the property is located on an Indian reservation, the chief executive officer of the Indian tribe, and shall allow not less than 30 nor more than 60 days for submitting written comments on the proposal. In the case of a landmark with more than 50 owners, the general notice specified in § 65.5(d)(3) will be used. In the case of National Historic Landmark districts for which no boundaries have been established, proposed boundaries shall be published in the *Federal Register* for comment and be submitted to the Committee on Energy and Natural Resources of the United States Senate and to the Committee on Interior and Insular Affairs of the United States House of Representatives and not less than 30 nor more than 60 days shall be provided for the submittal of written comments on the proposed boundaries.

(2) The proposed boundary and any comments received thereon shall be submitted to the Associated Director for National Register Programs, NPS, who may approve the boundary without reference to the Advisory Board or the Secretary.

(3) NPS will provide written notice of the approved boundary to the same parties specified in subsection (d)(1) of this section and by publication in the *Federal Register*.

(4) Management of the activities described in (d)(1), (2), and (3) is handled by the National Register of Historic Places, NPS, [Address: National Register of Historic Places, National Park Service, Department of the Interior, Washington, DC 20240].

(e) A technical correction to a boundary may be approved by the Chief, History Division, without Advisory Board review or Secretarial approval. NPS will provide notice, in writing, of any technical correction in a

boundary to the same parties specified in (d)(1).

§ 65.9 Withdrawal of National Landmark designation.

(a) National Historic Landmarks will be considered for withdrawal of designation only at the request of the owner or upon the initiative of the Secretary.

(b) Four justifications exist for the withdrawal of National Historic Landmark designation:

(1) The property has ceased to meet the criteria for designation because the qualities which caused it to be originally designated have been lost or destroyed, or such qualities were lost subsequent to nomination, but before designation;

(2) Additional information shows conclusively that the property does not possess sufficient significance to meet the National Historic Landmark criteria;

(3) Professional error in the designation; and

(4) Prejudicial procedural error in the designation process.

(c) Properties designated as National Historic Landmarks before December 13, 1980, can be dedesignated only on the grounds established in subsection (b)(1) of this section.

(d) The owner may appeal to have a property dedesignated by submitting a request for dedesignation and stating the grounds for the appeal as established in subsection (a) to the Chief, History Division, National Park Service, Department of the Interior, Washington, DC 20240. An appellant will receive a response within 60 days as to whether NPS considers the documentation sufficient to initiate a restudy of the landmark.

(e) The Secretary may initiate a restudy of a National Historic Landmark and subsequently a proposal for withdrawal of the landmark designation as appropriate in the same manner as a new designation as specified in § 65.5 (c) through (h). Proposals will not be submitted to the Advisory Board if the grounds for removal are procedural, although the Board will be informed of such proposals.

(f)(1) The property will remain listed in the National Register if the Keeper determines that it meets the National Register criteria for evaluation in 36 CFR 60.4, except if the property is dedesignated on procedural grounds.

(2) Any property from which designation is withdrawn because of a procedural error in the designation process shall automatically be considered eligible for inclusion in the National Register as a National Historic Landmark without further action and

will be published as such in the *Federal Register*.

(g)(1) The National Park Service will provide written notice of the withdrawal of a National Historic Landmark designation and the status of the National Register listing, and a copy of the report on which those actions are based to (i) the owner(s); (ii) the appropriate State official; (iii) the chief elected local official; (iv) the Members of Congress who represent the district and State in which the landmark is located; and (v) if the landmark is located on an Indian reservation, the chief executive officer of the Indian tribe. In the case of a landmark with more than 50 owners, the general notice specified in § 65.5(d)(3) will be used.

(2) Notice of withdrawal of designation and related National Register listing and determinations of eligibility will be published periodically in the *Federal Register*.

(h) Upon withdrawal of a National Historic Landmark designation, NPS will reclaim the certificate and plaque, if any, issued for that landmark.

(i) An owner shall not be considered as having exhausted administrative remedies with respect to dedesignation of a National Historic Landmark until after submitting an appeal and receiving a response from NPS in accord with these procedures.

§ 65.10 Appeals for designation.

(a) Any applicant seeking to have a property designated a National Historic Landmark may appeal, stating the grounds for appeal, directly to the Director, National Park Service, Department of the Interior, Washington, DC 20240, under the following circumstances.

Where the applicant—

(1) Disagrees with the initial decision of NPS that the property is not likely to meet the criteria of the National Historic Landmarks Program and will not be submitted to the Advisory Board; or

(2) Disagrees with the decision of the Secretary that the property does not meet the criteria of the National Historic Landmarks Program.

(b) The Director will respond to the appellant within 60 days. After reviewing the appeal the Director may: (1) deny the appeal; (2) direct that a National Historic Landmark nomination be prepared and processed according to the regulations if this has not yet occurred; or (3) resubmit the nomination to the Secretary for reconsideration and final decision.

(c) Any person or organization which supports or opposes the consideration of a property for National Historic

Landmark designation may submit an appeal to the Director, NPS, during the designation process either supporting or opposing the designation. Such appeals received by the Director before the study of the property or before its submission to the National Park System Advisory Board will be considered by the Director, the Advisory Board and the Secretary, as appropriate, in the designation process.

(d) No person shall be considered to have exhausted administrative remedies with respect to failure to designate a property a National Historic Landmark until he or she has complied with the procedures set forth in this section.

(FR Doc. 83-2734 Filed 2-1-83; 8:45 am)

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ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 123

[SW-2-FRL 2295-6]

Hazardous Waste Management Program; Phase I Interim Authorization

AGENCY: Environmental Protection Agency (EPA), Region II.

ACTION: Granting of phase I interim authorization to State hazardous waste program.

SUMMARY: The State of New Jersey has applied for Interim Authorization of its hazardous waste program under Subtitle C of the Resource Conservation and Recovery Act (RCRA) of 1976, as amended, and EPA guidelines for the approval of State hazardous waste programs (40 CFR Part 123, Subpart F). EPA has reviewed New Jersey's hazardous waste program and has determined that the program is substantially equivalent to the Federal program. EPA is hereby granting Phase I Interim Authorization to New Jersey to operate a hazardous waste program in lieu of Phase I of the Federal hazardous waste program in its jurisdiction.

EFFECTIVE DATE: February 2, 1983.

FOR FURTHER INFORMATION CONTACT: Deborah Craig, Solid Waste Branch, Air and Waste Management Division, U.S. Environmental Protection Agency, Region II, 26 Federal Plaza, New York, New York 10278, 212/264-5166.

SUPPLEMENTARY INFORMATION:

I. Background

Subtitle C of RCRA, requires EPA to establish a comprehensive Federal program to assure the safe management of hazardous waste. Once a Federal program is established, EPA is

authorized under Section 3006 of RCRA to approve State hazardous waste programs to operate in lieu of the Federal program in their jurisdictions. Two types of State programs approvals are authorized under RCRA: "Final Authorization" is a permanent approval which may be granted to States whose programs are "equivalent" to and "consistent" with the Federal program and provide adequate enforcement; "Interim Authorization" is a temporary approval for States which might not meet the requirements of Final Authorization but whose programs are at least "substantially equivalent" to the Federal program. RCRA contemplates that States receiving Interim Authorization will use the Interim Authorization period to make the changes in their regulations and statutes necessary to qualify for Final Authorization.

On May 19, 1980, EPA published the first phase of the Federal hazardous waste program regulations (40 CFR Parts 260-263 and 265) including guidelines for authorizing State hazardous waste program under Section 3006 (40 CFR Part 123). These guidelines set forth the requirements for Interim Authorization and the procedures which EPA will follow in acting on State applications for Interim Authorization. They also provide that EPA will grant Interim Authorization in two major phases (Phase I and Phase II), corresponding to the two major phases of the Federal program.

On January 11, 1982, the State of New Jersey submitted to EPA its complete application for Phase I Interim Authorization (IA application). In the February 11, 1982 Federal Register (47 FR 8298), EPA announced the availability for public review of the New Jersey application. EPA also indicated that a public hearing would be held on March 24, 1982, with the public record open until March 31, 1982. At the public hearing, the New Jersey Department of Environmental Protection (DEP) made available copies of draft amendments to its hazardous waste regulations which were subsequently proposed in the October 18, 1982 State Register. These and other amendments were initially requested by EPA when it commented on an earlier draft version of the State's IA application. On May 10, 1982, DEP requested that EPA delay making a final determination on the State's IA application until after the State had an opportunity to solicit public comment on the regulatory amendments requested by EPA. EPA granted DEP's request. Presented below in Section II of this notice is a synopsis of the public

comments on the State's IA application and EPA's responses.

After detailed review of the final New Jersey IA application, EPA transmitted comments to DEP on June 1, 1982. These comments requested additions and revisions to the Program Description, Attorney General's Statement, Memorandum of Agreement and Authorization Plan portions of the IA application, including the State's hazardous waste regulations. On December 17, 1982, the State submitted amendments to the above mentioned portions of the IA application.

The major issue raised by EPA concerned the confidentiality of information obtained by inspection. New Jersey law may restrict the State's ability to use confidential information collected during inspections in enforcement proceedings or in court, and to share such information with EPA. DEP satisfied this area of concern by amending the Attorney General's Statement so as to commit the State to rely upon RCRA Section 3007(a) to support its inspection authority. As a result of such reliance on Section 3007(a), Section 3007(b) of RCRA would govern the use of information gained through inspections. Thus, there would be no unacceptable restrictions upon the use of information obtained through inspections.

The minor comments in EPA's June 1, 1982 letter were also addressed by DEP in its December 17, 1982 submission. The following summarizes the most significant of these comments and the State's responses:

(1) A Deputy Attorney General signed the Attorney General's Statement in lieu of the Attorney General. Under 40 CFR 123.125, this certification must be made by the Attorney General. In a letter dated August 18, 1982, the Assistant Attorney General demonstrated that the Deputy had the authority to perform this duty for the Attorney General.

(2) New Jersey's statutory definition of "solid waste" excludes from regulation, industrial sewage treated at publicly-owned treatment works (POTWs) devoted exclusively to the treatment of industrial wastes. This exclusion is not provided for under the RCRA definition. DEP satisfied this area of concern by amending the Program Description to include a demonstration that no existing POTWs in the State treated exclusively industrial wastes. Therefore, the statutory exemption could not be utilized by any existing POTWs.

(3) Pursuant to 40 CFR 123.127, the State must identify those statutory and regulatory changes needed to make the State program equivalent to the Federal

THE NATIONAL HISTORIC LANDMARKS PROGRAM

The National Park Service conducts the National Historic Landmarks Program to identify, designate, recognize, and protect buildings, structures, sites, and objects of national significance. These properties commemorate and illustrate the history and culture of the United States. This statement explains how the Secretary of the Interior selects these properties, how they are recognized and protected, and the effects of designation. The relationship of the National Historic Landmarks Program to other cultural resources programs of the Service and other bureaus is specified. Sources of additional information are also cited.

Landmark designation offers advantages to owners who wish to preserve their properties. It aids planning by government agencies, private organizations, and individuals because it is the primary Federal means of weighing the national significance of historic properties. The program is one of the major tools for scrutinizing areas proposed for addition to the National Park System and for nomination to the World Heritage List.

The Service conducts the program for the Secretary of the Interior. It is a cooperative endeavor of government agencies, professionals, and independent organizations sharing knowledge with the Service and working jointly to identify and preserve National Historic Landmarks. The Service also offers advice and assistance to owners of Landmarks. The program is an important aid to the preservation of many outstanding historic places that are not in the National Park System. By late 1983, 1599 properties had been designated National Historic Landmarks.

DESIGNATION OF NATIONAL HISTORIC LANDMARKS

Landmarks are identified by theme and special studies prepared or overseen by Service professionals. Nominations for designation are then evaluated by the National Park System Advisory Board, a committee of scholars and other citizens. The Board recommends properties that should be designated to the Secretary; however, decisions on designation rest with the Secretary.

Theme studies are surveys of fields of American culture. In them, a number of properties dealing with the same subject are evaluated at the same time, using the National Historic Landmarks criteria. Special studies for Landmark designation may also be conducted. These may be mandated by the Congress or the Executive Branch and often include endangered properties.

The Service selects the places for study and informs owners and appropriate government officials whose recommendations are considered in conducting the study. The researcher gathers information on the history, significance, description, and integrity of the property, prepares a statement of its relationship to the criteria and visits the property. A study appears as a formal nomination ordinarily presented to the Advisory Board for evaluation.

Before the Board reviews a nomination, the owners, specified government officials, and the public are invited to comment and may attend the Board's meeting. Owners of private property may object to designation. The Board may recommend to the Secretary that a property be designated or not, declared eligible for designation, or deferred for further study. The Director of the National Park

Service reviews the nomination and the Board's recommendations and transmits them to the Secretary along with his own recommendations and any public comments. The Secretary reviews this transmittal and acts on the recommendations.

Certain rules govern the Secretary's decision. If a private owner (or the majority of owners in a historic district) objects to designation, the Secretary may not make the designation but may, instead, declare the property eligible for designation. Places which the Secretary finds do not meet the criteria may be listed in, or determined eligible for, the National Register of Historic Places, based on their local or State importance.

In cases of endangered properties, the Secretary may designate without Board review. Notice, nomination, and owner involvement are generally the same as for studies reviewed by the Board.

RECOGNITION OF NATIONAL HISTORIC LANDMARKS

After the Secretary has designated a Landmark, the owner receives a certificate of designation signed by the Secretary and the Director. The Service invites the owner to accept a free plaque bearing the name of the property and attesting to its national significance. The plaque is presented to owners who pledge to preserve the Landmark and display the plaque publicly and properly. The certificate and plaque remain the property of the Service, but are entrusted to the care of the owner.

In accepting the plaque, the owner gives up none of the rights and privileges of ownership or use of the property; nor does the Department of the Interior acquire a legal interest in the property. If asked and if feasible, the Service will assist in a ceremony for the presentation of the plaque and certificate. The owner of a Landmark is not required to grant public access, although many do. Thus, persons wishing to visit a Landmark should inquire in advance whether the property is open to the public.

EFFECTS OF DESIGNATION

The program focuses attention on places of exceptional value to the nation as a whole, by recognizing and promoting the preservation efforts of private organizations, individuals, and government agencies. Designation often leads to increased public attention to and interest in a property.

Legal effects of designation may help preserve historic places. These effects require that:

--before approval of any Federal project directly and adversely affecting a Landmark, the responsible Federal agency must, to the maximum extent possible, plan and act to minimize harm to the property. The agency must also permit the Advisory Council on Historic Preservation the opportunity to comment on the undertaking.

--when Landmarks demonstrate known or anticipated threats to their integrity, they are identified in an annual report by the Secretary to the Congress. The Congress may then consider legislation to aid in their preservation.

--when surface mining activity may damage a Landmark, the Secretary must report to the Advisory Council and request the Council's advice on alternatives to lessen or eliminate the danger.

Upon designation, properties not listed in the National Register of Historic Places are entered in it. The Register, the Federal Government's list of places worthy of preservation, includes places of State and local significance, as well as Landmarks. Listing of private property in the Register does not prohibit, under Federal law or regulation, any actions which may otherwise be taken by the owner.

Additional effects resulting from Register listing of Landmarks, which may be beneficial to owners, include:

--special Federal Income Tax incentives for rehabilitation of privately owned structures

--Federal Income Tax incentives for donations that result in preservation of the property

--Federal grants (to the extent available) for preservation, and

--consideration of historic values in issuing surface coal mining permits.

CONTINUING CARE OF NATIONAL HISTORIC LANDMARKS

The Service, through its Preservation Assistance Division and its Regional offices, maintains a continuing relationship with Landmark owners. Visits and other means are used to advise owners about preservation standards and practices and, if appropriate, interpretation to the public. Owners are informed of tax advantages, Federal grants, and other assistance.

The Service monitors the condition of Landmarks. This review results in the annual report to the Congress identifying threatened Landmarks. Information on assistance to Landmark owners is available from National Park Service Regional Offices and the Preservation Assistance Division, National Park Service, Washington, DC 20240.

APPEALS FOR DESIGNATION

A person who wishes to have a property designated a National Historic Landmark may appeal to the Director of the National Park Service if he disagrees with a decision that the property does not meet the Landmarks criteria and will not be studied, or will not be designated by the Secretary. The Director may then order a Landmark nomination prepared and processed, or submit a nomination to the Secretary for reconsideration, or deny the appeal.

LOSS OF DESIGNATION AND ALTERATION OF BOUNDARIES

Designation may be withdrawn for four reasons: (1) the Landmark has lost the qualities for which it was designated; (2) new information demonstrates that the property does not meet the criteria; (3) professional error has been made; or (4) procedural error occurred in the designation process. (For legal reasons, a designation before December 13, 1980, can be withdrawn only if the property in question has lost the qualities for which it was originally selected.)

Appeals to revoke designations, or modify Landmark boundaries, are made to the Chief Historian, History Division, National Park Service. The History Division may also initiate such studies. If it decides a study for revocation or boundary change is merited, it will conduct a study in the same manner as a study for designation.

A Landmark that has lost its designation may remain listed in the National Register unless dedesignation has occurred on procedural grounds. In the latter case, the property will still be considered eligible for inclusion in the Register as a National Historic Landmark. When designation is withdrawn, the Service reclaims the National Historic Landmark certificate and plaque.

SOURCES OF ADDITIONAL INFORMATION

The legal description of the National Historic Landmarks Program is found in the U.S. Code of Federal Regulations (36 CFR 65). The regulations cite the statutory authorities for the program and related Federal laws. State and local historic preservation laws and regulations may also apply to Landmarks and other historic properties; information on these matters is best obtained from the State Historic Preservation Officer in the State or other jurisdiction in which the property is located.

The list of Landmarks is published in a booklet entitled National Historic Landmarks, issued periodically by the National Park Service. Ten theme studies have been published in a book series describing both Landmarks and units in the National Park System.

Information on the National Historic Landmarks Program and allied preservation programs is available by addressing the Associate Director, Cultural Resources, National Park Service, Washington, DC, 20240, and specifying one or more of the following programs:

--World Heritage Program: The United States nominates National Parks and National Historic Landmarks of international significance to the World Heritage List maintained by UNESCO.

--National Register of Historic Places: Historic properties are nominated to this list by the State Historic Preservation Officers and Federal Agency Historic Preservation Officers. National Register listing is ordinarily required before a property is considered for National Historic Landmark designation.

--Historic American Buildings Survey (HABS): This survey records, measures, photographs, and studies buildings of importance in American architecture and history. Its records are located in the Library of Congress.

--Historic American Engineering Record (HAER): The companion of HABS, this program focuses on important examples of American engineering.

--Archeological Assistance: This program develops standards, guidelines, regulations and other technical materials for the identification, evaluation, and protection of archeological resources on public and Indian lands. It also advises Federal agencies on the recovery of archeological resources and issues permits for archeological investigations on public and Indian lands.

CRITERIA OF NATIONAL SIGNIFICANCE

The following criteria are prescribed for evaluating properties for designation as National Historic Landmarks. The National Park System Advisory Board applies them in reviewing nominations and in preparing recommendations to the Secretary. Studies leading to designation are prepared by historians, archeologists, and anthropologists familiar with the broad range of the Nation's historic and prehistoric sites and themes. The criteria establish the qualitative framework in which comparative analysis of historic properties takes place.

National significance is ascribed to districts, sites, buildings, structures and objects that possess exceptional value or quality in illustrating or interpreting the heritage of the United States in history, architecture, archeology, engineering and culture and that possess a high degree of integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- (1) that are associated with events that have made a significant contribution to, and are identified with, or that outstandingly represent, the broad national patterns of United States history and from which an understanding and appreciation of those patterns may be gained; or
- (2) that are associated importantly with the lives of persons nationally significant in the history of the United States; or
- (3) that represent some great idea or ideal of the American people; or
- (4) that embody the distinguishing characteristics of an architectural type specimen exceptionally valuable for the study of a period, style or method of construction, or that represent a significant, distinctive and exceptional entity whose components may lack individual distinction; or
- (5) that are composed of integral parts of the environment not sufficiently significant by reason of historical association or artistic merit to warrant individual recognition but collectively compose an entity of exceptional historical or artistic significance, or outstandingly commemorate or illustrate a way of life or culture; or
- (6) that have yielded information of major scientific importance by revealing new cultures, or by shedding light upon periods of occupation over large areas of the United States. Such sites are those which have yielded, or which may reasonably be expected to yield, data affecting theories, concepts and ideas to a major degree.

Exclusions and exceptions to exclusions: Ordinarily, cemeteries, birthplaces, graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings and properties that have achieved significance within the past 50 years are not eligible for designation. If such properties fall within the following categories they may, nevertheless, be found to qualify:

- (1) a religious property deriving its primary national significance from architectural or artistic distinction or importance in a historical field other than religion; or
- (2) a building or structure removed from its original location but which is nationally significant primarily for its architectural merit, or for association with persons or events of transcendent importance in the nation's history and the association consequential; or
- (3) a site of a building or structure no longer standing but the person or event associated with it is of transcendent importance in the nation's history and the association consequential; or
- (4) a birthplace, grave or burial if it is of a historical figure of transcendent national significance and no other appropriate site, building or structure directly associated with the productive life of that person exists; or
- (5) a cemetery that derives its primary national significance from graves of persons of transcendent importance, or from an exceptionally distinctive design or an exceptionally significant event; or
- (6) a reconstructed building or ensemble of buildings of extraordinary national significance when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other buildings or structures with the same association have survived; or
- (7) a property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own national historical significance; or
- (8) a property achieving national significance within the past 50 years if it is of extraordinary national importance.

History Division
December 20, 1983



What are National Historic Landmarks?

National Historic Landmarks are recognized as our Nation's most important historic and cultural resources. They are buildings, historic districts, structures, sites, and objects that possess exceptional value or quality in illustrating or interpreting the heritage of the United States. Each year some of these Landmarks are threatened with imminent demolition or are seriously damaged through neglect, erosion, fire, vandalism, development pressures, pot-hunting, and floods. Although these Landmarks may represent a small percentage of the total, their potential destruction would represent a serious and irrevocable loss to the Nation.

When the National Historic Landmark program was enacted in 1935, it was designed, in part, to identify nationally significant properties which might be considered for inclusion into the National Park System. Over the years, it became apparent that Federal acquisition was not economically feasible or practical for most Landmarks, and alternative means for ensuring the long-term preservation of Landmarks other than fee acquisition had to be developed. Today, through a variety of innovative programs within the National Park Service (NPS), some measure of preservation assistance is available to owners of Landmarks. These programs, several of which utilize Federal funding to stimulate substantial private investment, are described below; more detailed information may be obtained from the specific NPS offices listed at the end of this booklet.



Chapel Hall, Gallaudet College, Washington, D.C. Gallaudet College was founded in 1864 as the first college for the deaf in the United States. Photo by P. Andrus.

Annual Monitoring

Since 1976, the Secretary of the Interior has been responsible for monitoring the status of all National Historic Landmarks and for reporting to Congress those Landmarks which are seriously damaged or imminently threatened with such damage. These Landmarks are called "Priority 1" Landmarks and are listed in the annual "Section 8 Report to Congress on Threatened and Damaged National Historic Landmarks." This annual report identifies the nature of the threat and damage and includes immediate and long-term recommendations for preserving the endangered Landmark. A Landmark's inclusion in the Section 8 Report requires no compliance action on the part of the Landmark owner nor the parties causing the damage or threat. Rather, the Section 8 Report is designed to inform Congress and the preservation community of the endangered status of these properties and encourage preservation action. Copies of this report are made available to Congress, Landmark owners, Federal agencies and State and local officials.

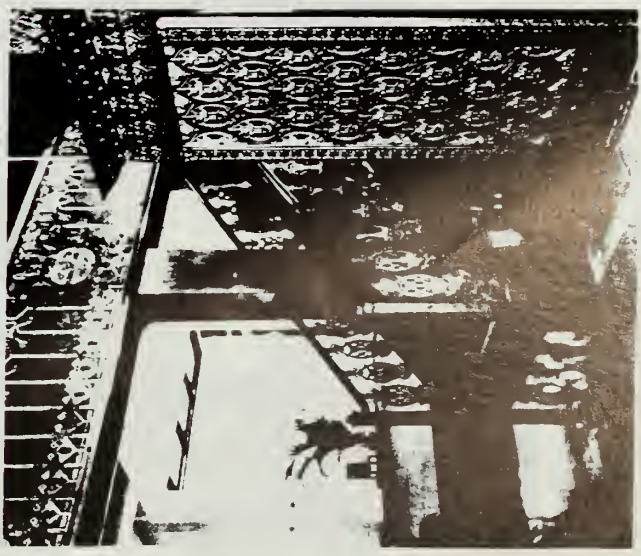
The Section 8 Report to Congress

"Priority 2" Landmarks are also identified as part of the NPS monitoring effort. These are Landmarks which are particularly susceptible to serious damage or threat at this time but whose conditions are not serious enough at the present time to warrant listing in the Section 8 Report. "Priority 3" Landmarks are those which appear to be receiving proper care and maintenance and which exhibit little or no known threat or damage. The priority ratings for each Landmark are evaluated annually.

Cahokia Mounds, St. Claire County, IL. This is the largest prehistoric archeological site in America and one of the Nation's few cultural resources included on the World Heritage List. It is seriously threatened with severe erosion. Photo by the State of Illinois Department of Conservation.

Eastern State Penitentiary, Philadelphia, PA. Constructed in the 1820's, this prison became an international model for penal design and management. This vacant and deteriorated building has been listed in the Section 8 Report for several years. Photo by J. Travers.

Prudential (Guaranty) Building, Buffalo, NY. Designed by Louis Sullivan, this office building was one of the earliest skyscrapers in America. It was vacant for years before being rehabilitated in 1983 using Federal tax incentives. Photo by Patricia Layman Bazelton.



Technical Assistance

The National Park Service provides technical preservation advice to all owners of National Historic Landmarks through its regional offices listed at the end of this booklet. General inquiries related to the preservation of Landmarks are routinely answered by the NPS by telephone or letter throughout the year. In some cases, onsite consultations are performed by NPS staff. Answers to inquiries regarding general maintenance and deterioration, and sources of financial assistance are often discussed during annual monitoring.

Federal tax incentives are available for rehabilitating income-generating historic properties; since 1976 these incentives have been utilized to spur the preservation of various National Historic Landmarks. Historic buildings used for income-generating purposes that are substantially rehabilitated can qualify for an investment tax credit. Several large, underutilized Landmark buildings such as Richmond's Old City Hall in Richmond, Virginia, the Prudential (Guaranty) Building in Buffalo, New York, and numerous townhouses in urban National Historic Landmark Districts are examples of Landmark buildings preserved by use of the Federal tax incentives program. Easement donations are also available as a Federal income tax deduction.

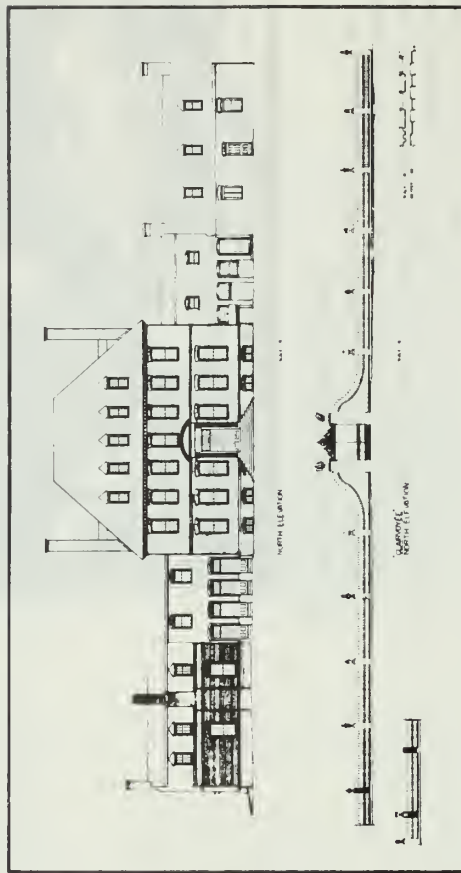
The National Park Service develops and disseminates professional standards for conservation and preservation activities, publishes and distributes information on preservation and conservation techniques, and makes this information available to Landmark owners and administrators upon request. Most National Park Service technical preservation publications available for sale to the general public may be obtained by Landmark owners at no charge. A complete list of publications is available from NPS regional offices.

Grant-in-Aid Assistance

Federal funding is not sufficient to assist all National Historic Landmarks. In recent years, Federal grants-in-aid through the Historic Preservation Fund have been limited to survey and planning work; these funds are not generally available for the restoration or repair of specific Landmarks. Landmark owners desiring grant-in-aid assistance should contact their State Historic Preservation Officer for available State or local funding.

HABS/HAER Recording

Documentation of National Historic Landmarks is an important program of the National Park Service. The Historic American Buildings Survey (HABS) and the Historic American Engineering Record (HAER) produce archival documentation of buildings and structures through measured drawings, photographs, and oral and written histories. HABS/HAER documentation creates a permanent written and pictorial record for scholarly research, and can prove extremely valuable should a Landmark be seriously damaged or destroyed. Recording is often funded by other Federal agencies, States, and private individuals and corporations.



Westover, Charles City vic., VA. Private donations assisted in funding the HABS recording of this Georgian mansion. An easement was also donated by the owners for the long-term protection of the Landmark. Drawing by the Historic American Building Survey, Peter G. Darlow, delineator, 1979.

Advisory Services

Federal Tax Incentives

Technical Information

Indepth Inspections

Each year a limited number of Priority 1 and 2 National Historic Landmarks are selected for indepth site inspections funded and coordinated by the National Park Service. The purpose of these indepth inspections is to analyze the specific condition of the Landmark, identify recommended work treatments for correcting identified damages, prioritize work needs, and estimate the costs for carrying out this work. Indepth inspections are performed by architects and engineers in private practice who have experience with historic buildings and structures and are located in the vicinity of the NHL being inspected. Indepth inspections of archeological sites are performed by archeologists often associated with area universities.

Information derived from the indepth inspections is compiled in a building condition assessment report. This report is made available to owners, preservation organizations, and interested public and private groups. The National Park Service also assists Landmark owners in identifying available sources of private and public funds for undertaking the preservation work recommended in the condition assessment reports.

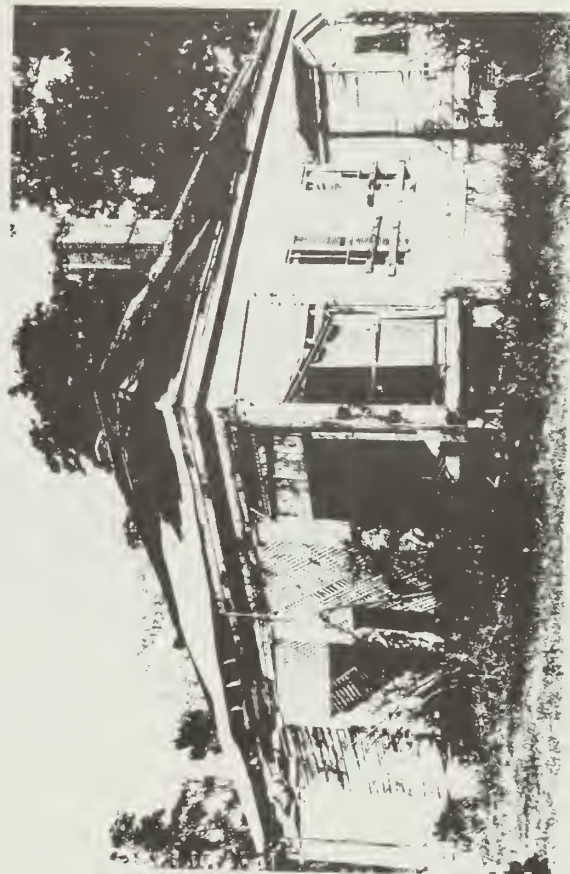


Monte Cristo Cottage (Eugene O'Neill House), New London, CT. O'Neill, one of America's outstanding dramatists, spent most of his early summers in this house and probably wrote his first plays here. An NPS indepth inspection identified several sources of moisture damage to this Landmark. Photo by A.V. Scarano.

Private and Corporate Donations

The National Historic Landmark Fund

The National Park Service helps to funnel donations of cash, building materials and professional services to specific National Historic Landmarks of the donor's choice. National Historic Landmarks can be matched to the interests of the prospective donors. Landmarks can be selected for their associations with specific historical themes, events or individuals, or for their architectural style, building type or construction material. Landmarks in need of various services or building products which correspond to a donor's business also can be selected. Assistance to National Historic Landmark archeological sites is also possible. In working with donors, the National Park Service gives priority to endangered National Historic Landmarks and those Landmarks in which critical needs have been identified by an indepth inspection.



Coker House, Champion Hill Battlefield, Vicksburg, MS. This badly deteriorated Greek Revival house is one of the few remaining historic structures on Champion Hill Battlefield. The battle fought here was the precursor to the siege of Vicksburg. An NPS indepth inspection identified the need for major roof, foundation and porch repairs to save this Landmark. Photo by J. Travers.

For further information about these programs for National Historic Landmarks, or the National Historic Landmark Fund, contact one of the following offices of the National Park Service or the appropriate State Historic Preservation Office.

NATIONAL PARK SERVICE OFFICES RESPONSIBLE FOR MONITORING AND DOCUMENTING NATIONAL HISTORIC LANDMARKS

Landmark Assistance
Preservation Assistance Division
National Park Service
P.O. Box 37127
Washington, D.C. 20013-7217
(202) 343-9581

Historic American Buildings Survey
Historic American Engineering Record
National Park Service
P.O. Box 37127
Washington, D.C. 20013-7217

Alaska Region
National Park Service
2525 Gambell Street, Room 107
Anchorage, Alaska 99503
(907) 261-2632

Mid-Atlantic Region
National Park Service
143 South Third Street
Philadelphia, Pennsylvania 19106
(215) 597-7013

Connecticut, Delaware, District of Columbia,
Indiana, Maine, Maryland, Massachusetts,
Michigan, New Hampshire, New Jersey, New
York, Ohio, Pennsylvania, Rhode Island, Ver-
mont, Virginia, West Virginia

Rocky Mountain Region
National Park Service
655 Parfet Street
P.O. Box 25287
Denver, Colorado 80225
(303) 236-8675

Colorado, Illinois, Iowa, Kansas, Minnesota,
Missouri, Montana, Nebraska, New Mexico,
North Dakota, Oklahoma, South Dakota,
Texas, Utah, Wisconsin, Wyoming



Grey Towers, "The Castle," Glenside, PA. This architecturally significant home exemplifies the type of grand residences built for families of great wealth at the turn of the century. It is now owned by Beaver College. Although well maintained by its conscientious owners, an NPS in-depth inspection identified a number of costly structural and conservation problems. Photo courtesy of Beaver College.

Southeast Region
National Park Service
75 Spring Street, SW
Atlanta, Georgia 30303
(404) 221-2641

Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Puerto Rico, South Carolina, Tennessee, Virgin Islands

Western Region
National Park Service
450 Golden Gate Avenue
P.O. Box 36063
San Francisco, California 94102
(415) 556-7741

Arizona, California, Hawaii, Idaho, Nevada, Oregon, Washington

STATE HISTORIC PRESERVATION OFFICERS

Alabama: Executive Director, Alabama Historical Commission, 725 Monroe Street, Montgomery, AL 36130. (205) 261-3184.
Alaska: Chief of History and Archeology, Division of Parks, Office of History and Archeology, Pouch 7001, Anchorage, AK 99501. (907) 762-4108. **American Samoa:** Historic Preservation Officer, Department of Parks and Recreation, Government of American Samoa, P.O. Box 1268, Pago Pago, American Samoa 96799. **Arizona:** Chief, Office of Historic Preservation, Arizona State Parks, 1688 West Adams, Phoenix, AZ 85007. (602) 255-4174. **Arkansas:** Director, Arkansas Historic Preservation Program, The Heritage Center, Suite 200, 225 East Markham, Little Rock, AR 72201. (501) 371-2763. **California:** State Historic Preservation Officer, Office of Historic Preservation, Department of Parks and Recreation, P.O. Box 2390, Sacramento, CA 95811. (916) 445-8006. **Colorado:** State Historic Preservation Officer, Colorado Heritage Center, 1300 Broadway, Denver, CO 80203. (303) 886-2136. **Connecticut:** Director, Connecticut Historical Commission, 59 South Prospect Street, Hartford, CT 06106. (203) 566-3005. **Delaware:** Director, Division of Historical and Cultural Affairs, Hall of Records, Dover, DE 19901. (302) 736-5314. **District of Columbia:** Director, Department of Consumer and Regulatory Affairs, 614 H Street, NW, Washington, DC 20001. (202) 727-7120. **Florida:** Director, Division of Archives, History, and

Records Management, Department of State, The Capitol, Tallahassee, FL 32301. (904) 487-2333. **Georgia:** Chief, Historic Preservation Section, Department of Natural Resources, 270 Washington Street, SW, Room 704C, Atlanta, GA 30334. (404) 656-2840. **Guam:** Director, Department of Parks and Recreation, 490 Naval Hospital Road, Agaña Heights, GQ 96910. **Hawaii:** State Historic Preservation Officer, Department of Land and Natural Resources, P.O. Box 621, Honolulu, HI 96809. (808) 548-7460. **Idaho:** Historic Preservation Coordinator, Idaho Historical Society, 610 North Julia Davis Drive, Boise, ID 83706. (208) 334-2120. **Illinois:** Historic Preservation Agency Old State Capitol, Springfield, IL 62701. (217) 785-4512. **Indiana:** Director, Department of Natural Resources, 608 State Office Building, Indianapolis, IN 46204. (317) 232-4020. **Iowa:** Director, Iowa State Historical Department, Office of Historic Preservation, Historical Building, East 12th Street and Grand Avenue, Des Moines, IA 50319. (515) 281-3159. **Kansas:** Executive Director, Kansas State Historical Society, 120 West 10th Street, Topeka, KS 66612. (913) 296-3251. **Kentucky:** State Historic Preservation Officer, Director, Kentucky Heritage Council, Capital Plaza Tower, 12th Floor, Frankfort, KY 40601. (502) 564-7005. **Louisiana:** Assistant Secretary, Office of Cultural Development, P.O. Box 44247, Baton Rouge, LA 70804. (504) 925-3884. **Maine:** Director, Maine Preservation Commission, 55 Capitol Station 65, Augusta, ME 04333. (207) 289-2133. **Maryland:** State Historic Preservation Officer, John Shaw House, 21 State Circle, Annapolis, MD 21401. (301) 269-2851. **Massachusetts:** Executive Director, Massachusetts Historical Commission, 80 Boylston Street, Boston, MA 02116. (617) 727-8470. **Michigan:** Director, History Division, Department of State, 208 North Capitol Lansing, MI 48918. (517) 373-6362. **Minnesota:** Director, Minnesota Historical Society, 690 Cedar Street, St. Paul, MN 55101. (612) 296-2747. **Mississippi:** Director, State of Mississippi Department of Archives and History, P.O. Box 571, Jackson, MS 39205. (601) 359-1424. **Missouri:** Director, State Department of Natural Resources, P.O. Box 176, Jefferson City, MO 65102. (314) 751-4422. **Montana:** State Historic Preservation Officer, Montana Historical Society, 225 North Roberts Street, Veterans Memorial Building, Helena, MT 59620. (406) 444-7715. **Nebraska:** Director, Nebraska State Historical Society, 1500 R Street, P.O. Box 82554, Lincoln, NE 68501. (402) 471-3850. **Nevada:** Director, Department of Conservation and Natural Resources, Nye Building, Room 213, 201 South Fall Street, Carson City, NV 89710. (702) 885-4360. **New Hampshire:** Commissioner, Department of Resources and Economic Development, P.O. Box 856, Concord, NH 03301. (603) 271-2411. **New Jersey:** Commissioner, Department of Environmental Protection, CN 402, Trenton, NJ 08625. (609) 292-2885. **New Mexico:** State Historic Preservation Officer, Historic Preservation Division, Office of Cultural Affairs, Villa Rivera, Room 101, 228 East Palace Avenue, Santa Fe, NM 87503. (505) 827-8320. **New York:** Commissioner, Office of Parks, Recreation, and Historic Preservation, Agency Building #1, Empire State Plaza, Albany, NY 12238. (518) 474-0444. **North Carolina:** Director, Division of Archives and History, Department of Cultural Resources, 109 East Jones Street, Raleigh, NC 27611. (919) 733-7305. **North Dakota:** Superintendent, North Dakota Historical Society, ND Heritage Center, Fargo, ND 58505. (701) 224-2667. **Northwestern Mariana Islands:** Historic Preservation Officer, Department of Community and Cultural Affairs, Commonwealth of the Northern Mariana Islands, Saipan, NMI 96950. **Ohio:** State Historic Preservation Officer, Ohio Historical Society, 1985 Velma Avenue, 71 at 17th Avenue, Columbus, OH 43211. (614) 466-1500. **Oklahoma:** State

Historic Preservation Officer, Oklahoma Historical Society, Historical Building, 2100 North Lincoln, Oklahoma City, OK 73105. (405) 521-2491. **Oregon:** State Parks Superintendent, 525 Trade Street, SE Salem, OR 97310. (503) 378-5019. **Pennsylvania:** State Historic Preservation Officer, Pennsylvania Historical and Museum Commission, P.O. Box 1026, Harrisburg, PA 17108. (717) 787-2891. **Commonwealth of Puerto Rico:** State Historic Preservation Office, Box 82, La Fortaleza, San Juan, PR 00901. (809) 721-4389. **Rhode Island:** Director, Rhode Island Department of Community Affairs, 150 Benefit Street, Providence, RI 02903. (401) 277-2678. **South Carolina:** Director, Department of Archives and History, 1430 Senate Street, Columbia, SC 29211. (803) 758-5816. **South Dakota:** State Historic Preservation Officer, Historical Center, P.O. Box 417, Vermillion, SD 57069. (605) 773-3458. **Tennessee:** State Historic Preservation Officer, Department of Conservation, 701 Broadway, Nashville, TN 37203. (615) 741-2301. **Texas:** Executive Director, Texas State Historical Commission, P.O. Box 12276, Capitol Station, Austin, TX 78711. (512) 475-3092. **Trust Territory of the Pacific Islands:** State Historic Preservation Officer, Land Resources Branch, Department of Resources and Development, Trust Territory of the Pacific Islands, Saipan, Mariana Islands, TT 96950. **Utah:** State Historic Preservation Officer, Utah State Historical Society, 300 Rio Grande, Salt Lake City, UT 84101. (801) 533-7039. **Vermont:** Secretary, Agency of Development and Community Affairs, Pavilion Office Building, Montpelier, VT 05602. (802) 828-3211. **Virginia:** Executive Director, Virginia Historic Landmarks Commission, 221 Governor Street, Richmond, VA 23219. (804) 786-3143. **Virgin Islands:** State Historic Preservation Officer, P.O. Box 3088, St. Croix, Virgin Islands, VQ 00820. (809) 773-1082. **Washington:** State Historic Preservation Officer, 111 West 21st Avenue, KL-11, Olympia, WA 98504. (206) 753-4011. **West Virginia:** Commissioner, Department of Culture and History, State Capitol Complex, Charleston, WV 25304. (304) 348-0220. **Wisconsin:** Director, Historic Preservation Division, State Historical Society of Wisconsin, 816 State Street, Madison, WI 53706. (608) 262-3266. **Wyoming:** Director, Wyoming State Archives, Barrett Building, 2301 Central Avenue, WY 82002. (307) 777-7697

NATIONAL REGISTER of HISTORIC PLACES INFORMATION

U.S. Department of the Interior
National Park Service
Interagency Resources Division

June 1988

Following is a list of the most commonly asked questions, with answers, about the National Register of Historic Places.

1. What is the National Register of Historic Places?

The National Register, maintained by the National Park Service, Department of the Interior, is the nation's official list of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, engineering, and culture.

2. What are the benefits and restrictions of listing?

In addition to honorific recognition, listing in the National Register results in the following benefits for historic properties:

- . consideration in planning for Federal, federally licensed, and federally assisted projects;

Section 106 of the National Historic Preservation Act of 1966 requires that Federal agencies allow the Advisory Council on Historic Preservation an opportunity to comment on all projects affecting historic properties either listed in or determined eligible for listing in the National Register. The Advisory Council oversees and insures the consideration of historic properties in the Federal planning process.

- . eligibility for certain Federal tax provisions;

Owners of properties listed in the National Register may be eligible for a 20 percent investment tax credit for the certified rehabilitation of income-producing certified historic structures such as commercial, industrial, or rental residential buildings. This credit can be combined with a straight-line depreciation period of 27.5 years for residential property and 31.5 years for nonresidential property for the depreciable basis of the

rehabilitated building reduced by the amount of the tax credit claimed. Federal tax deductions are also available for charitable contributions for conservation purposes of partial interests in historically important land areas or structures.

- . consideration of historic values in the decision to issue a surface mining permit where coal is located in accordance with the Surface Mining Control Act of 1977; and
- . qualification for Federal grants for historic preservation when funds are available.

Presently funding is unavailable for most categories of properties.

Owners of private properties listed in the National Register are free to maintain, manage, or dispose of their property as they choose provided that no Federal monies are involved.

3. What are the National Register criteria for evaluation?

The criteria are designed to guide State and local governments, Federal agencies, and others in evaluating potential entries in the National Register. The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling and association, and:

- a. that are associated with events that have made a significant contribution to the broad patterns of our history; or
- b. that are associated with the lives of persons significant in our past; or
- c. that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- d. that have yielded, or may be likely to yield, information important in prehistory or history.

Criteria considerations: Ordinarily cemeteries, birthplaces, or graves of historical figures, properties owned by religious institutions, or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years shall not be

considered eligible for the National Register. However, such properties will qualify if they are integral parts of districts that do meet the criteria of if they fall within the following categories:

- a. a religious property deriving primary significance from architectural or artistic distinction or historical importance; or
 - b. a building or structure removed from its original location but which is significant primarily for architectural value, or which is the surviving structure most importantly related with a historic person or event; or
 - c. a birthplace or grave of a historical figure of outstanding importance if there is no other appropriate site or building directly associated with his productive life; or
 - d. a cemetery that derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; or
 - e. a reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; or
 - f. a property primarily commemorative in intent if the design, age, tradition, or symbolic value has invested it with its own historical significance; or
 - g. a property achieving significance within the past 50 years if it is of exceptional importance.
4. How old does a property have to be to qualify for listing?

Generally, properties eligible for listing in the National Register are at least 50 years old. Properties less than 50 years of age must be exceptionally significant to be considered eligible for listing.

5. How is a property nominated to the National Register?

Properties are nominated to the National Register by the State Historic Preservation Officer (SHPO) of the State in which the property is located or by the Federal Preservation Officer for properties under Federal ownership or control. Ordinarily, State nomination forms are prepared by citizens or the staff of the SHPO. These nomination forms are then submitted to a State review board, composed of professionals in the fields of American history, architectural history,

architecture, prehistoric and historic archeology, and other related disciplines. The review board makes a recommendation to the SHPO either to approve the nomination if, in the board's opinion, it meets the National Register criteria or to disapprove the nomination if it does not.

During the time the proposed nomination is reviewed by the SHPO, property owners and local officials are notified of the intent to nominate. Local officials and property owners are given the opportunity to comment on the nomination and owners of private property are given an opportunity to object to or concur in the nomination. If the owner of private property or the majority of such owners for a property or district with multiple owners object to the nomination, the SHPO forwards the nomination to the National Park Service only for a determination about whether the property is eligible for listing. If the property is determined eligible for listing, although not formally listed, the Advisory Council must be afforded the opportunity to comment on any Federal project which may affect it.

If the review board and the SHPO agree on the eligibility of a property (and the owner has not objected to nomination), then the nomination is forwarded to the National Park Service in Washington to be considered for listing.

6. How long does the nomination process take?

The process varies from State to State depending on State workload, planning and registration priorities, and the schedule of the review board. The process takes a minimum of 90 days to fulfill all of the review and notification requirements provided that a complete and fully documented nomination form has been completed for the property.

Upon submission to the National Park Service, a decision on whether to list the property is made within 45 days.

Information on State and local historic designations and the availability of State or local preservation funding is available from the appropriate SHPO office. The addresses of all SHPOs are included in the enclosed National Register brochure.

The National Register of Historic Places



U.S. Department of the Interior
National Park Service
National Register of Historic Places
P.O. Box 37127
Washington, DC 20013-7127

The National Register of Historic Places

United States Department of the Interior
National Park Service

The National Register of Historic Places is the official list of the Nation's cultural resources worthy of preservation. Authorized under the National Historic Preservation Act of 1966, the National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect our historic and archeological resources. The National Register is administered by the National Park Service under the Secretary of the Interior. Properties listed in the National Register include districts, sites, buildings, structures and objects that are significant in American history, architecture, archeology, engineering, and culture. These resources contribute to an understanding of the historical and cultural foundations of the Nation.

The National Register includes:

- all historic areas in the National Park System;
- National Historic Landmarks which have been designated by the Secretary of the Interior for their significance to all Americans; and
- properties significant to the Nation, State, or community which have been nominated by the States, Federal agencies and others and have been approved by the National Park Service.



Dumbarton Bridge, District of Columbia, (Mary Randlett).

The National Register of Historic Places

Listing in the National Register has the following results which assist in preserving historic properties:

- Recognition that a property is of significance to the Nation, the State or the community.
- Consideration in the planning for Federal or federally assisted projects.
- Eligibility for Federal tax benefits.
- Consideration in the decision to issue a surface coal mining permit.
- Qualification for Federal assistance for historic preservation, when funds are available.

National Register properties are distinguished by having been documented and evaluated according to uniform standards. The Secretary of the Interior's National Register criteria for evaluation and documentation standards are used by every State and Territory and by Federal agencies to identify important historic and archeological properties worthy of preservation and of consideration in making planning and development decisions.

The National Register program provides Federal, State and local governments and the general public the following:

- National recognition of the value of historic properties individually and collectively to the Nation.
- Eligibility for Federal tax incentives and other preservation assistance.
- Assistance in cultural resource planning.

National Recognition

Americans are proud of their heritage and are honored when properties in their communities and States are entered in the National Register. Historic properties in a community are tangible links with the Nation's past that help provide a sense of identity and stability. The National Register, which recognizes the values of properties as diverse as a dugout shelter of an Oklahoma pioneer settler, the Breakers Mansion in Newport, and a 12,000-year-old prehistoric site, has helped many to appreciate the richness and variety of their heritage.



Historic Hill District, St. Paul, MN (Charles W. Nelson).

Listing properties in the National Register often changes the way communities perceive their historic resources and gives credibility to efforts of private citizens and public officials to preserve these resources as living parts of our communities. Listing in the National Register however, does not interfere with a private property owner's right to alter, manage or dispose of property.

Historical commissions, design review committees, or special zoning ordinances are established by State legislation or local ordinances; they are not a part of the National Register program. Information on any State or local law which may affect a historic property may be obtained from the State Historic Preservation Officer and the Mayor, City Council or other community officials.

Preservation Assistance

Private preservation efforts, spurred by the honor of National Register listing and made feasible by financial incentives, have resulted in a rise in the value of historic property and in the creation of construction, business and employment opportunities throughout the Nation. Documentation used for evaluating and registering historic properties is the basis for decisions about which properties merit tax incentives or available Federal assistance and how these properties should be treated to respect their historic character.

Tax Incentives for Rehabilitation. Since 1976, the Federal Internal Revenue Code has contained a variety of incentives to encourage

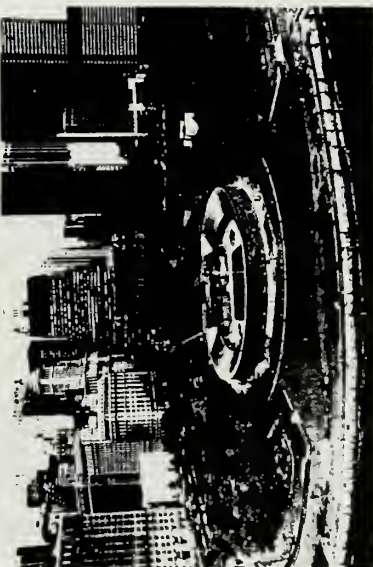
capital investment in historic buildings and to spur revitalization of historic neighborhoods. These incentives, including a 20% investment tax credit, encourage the preservation of historic commercial, industrial and rental residential buildings by allowing favorable tax treatments for rehabilitation and discouraging destruction of historic structures. Preservation tax incentives are available for any project which the Secretary of the Interior designates as a certified rehabilitation of a certified historic structure. A certified historic structure is any structure, subject to depreciation as defined by the Internal Revenue Code, which is listed individually in the National Register or located in a registered historic district and certified by the Secretary of the Interior as being of historic significance to the district. A certified rehabilitation is any rehabilitation of a certified historic structure that the Secretary of the Interior has determined is consistent with the historic character of the property or the district in which the property is located. To qualify for the tax incentives, property owners must complete a Historic Preservation Certification Application and secure certification from the Secretary of the Interior. Further information on these incentives and the application procedures may be obtained from the National Park Service Regional Office responsible for certification applications in your State, or by writing: Preservation Tax Incentives, National



Administration Building, University of Vermont



Shadous-on-the-Teché (National Trust for Historic Preservation), New Iberia, LA (Gleason Photography), Sand Key Lighthouse, Monroe, FL (J.F. Brooks, HABS).



Castle Clinton National Monument, New York, NY (Richard Frear, NPS).

Cultural Resource Planning

The goals of the preservation programs are to establish national standards for historic preservation, to identify and document significant historic resources in the United States, to assist in preservation efforts by providing assistance to public and private preservation agencies and organizations, and to educate the general public concerning the value of historic preservation. These programs are carried out for the Secretary of the Interior by the National Park Service in cooperation with the State Historic Preservation Officers, the Federal Preservation Officers, local governments and citizens. Information gathered during identification, evaluation and registration is important in identifying preservation needs, in planning cultural resource protection strategies, and in carrying out these strategies.

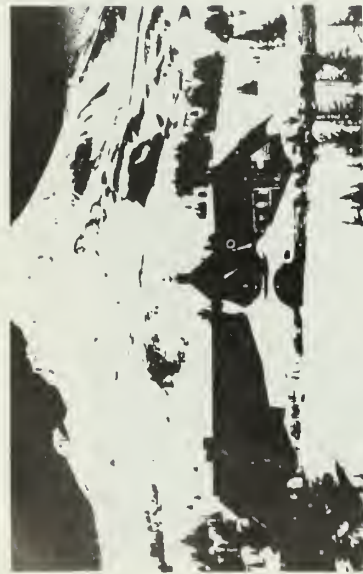
Federal Activities. Federal agencies are required by law to locate, inventory and nominate to the National Register historic properties in Federal ownership or control. The Federal agencies also are responsible for preserving historic properties under their ownership or control and for assuring that any property that might qualify for inclusion in the National Register is not inadvertently transferred, sold, demolished, substantially altered or allowed to deteriorate significantly. If, as a result of Federal action or assistance, a historic property is to be substantially altered or demolished, records are to be made for deposit in the Library of Congress or other agency designated by the Secretary of the Interior, for future use and reference. Agencies proposing projects which may affect a property



Bridgewater Woolen Mill, Bridgewater, VT

Easement Donations. The Federal Internal Revenue Code also provides for Federal income, estate, and gift tax deductions for charitable contributions of partial interests in real property (land and buildings). Taxpayers' gifts of qualified interests must be "exclusively for conservation purposes". One of these purposes is defined as "the preservation of an historically important land area or certified historic structure." Further information on easements may be obtained from the sources listed above in the tax incentives section.

Federal Historic Preservation Grants. Listing in the National Register qualifies a property for certain grants when funds are available. Information on this assistance should be obtained by writing: Preservation Grants, c/o the State Historic Preservation Officer of the State in



Timberline Lodge (National Historic Landmark), Mt. Hood National Forest, OR (Oregon State Highway Division).

listed in or eligible for the National Register must allow the Advisory Council on Historic Preservation an opportunity to comment prior to funding, licensing or granting assistance on such projects. The purpose of this review is not to impede or halt development, but rather to assure that the value of historic properties is given direct consideration in project planning decisions. Further information on the Advisory Council may be obtained by writing the Advisory Council on Historic Preservation, The Old Post Office Building, 1100 Pennsylvania Avenue N.W., Room 809, Washington, D.C. 20004.

Consideration of historic values is also a part of the decision to issue a surface coal mining permit, in accordance with the Surface Mining and Control Act of 1977.

State Activities. Most nominations to the National Register are made by the States through State Historic Preservation Officers. State Historic Preservation Programs must be approved by the Secretary of the Interior before the States nominate historic properties to the National Register.

In addition to nominating historic properties to the National Register, the State Historic Preservation Officer prepares and implements a comprehensive Statewide Historic Preservation Plan, administers the State program of Federal assistance for historic preservation within the State, conducts a statewide survey of historic properties, and cooperates with Federal, State and local officials and others to assure that historic properties are taken into consideration at all levels of planning and development. The State Historic Preservation Officer also provides public information, education and training, and

technical assistance relating to the Federal and State Historic Preservation Programs.

Local Government Activities. The State Historic Preservation Officer also assists local governments in becoming certified to participate in the Federal Historic Preservation Program, including the process for nominating properties to the National Register.

Criteria for Evaluation

The National Register's standards for evaluating the significance of properties were developed to recognize the accomplishments of all peoples who have made a contribution to our country's history and heritage. The criteria are designed to guide State and local governments, Federal agencies, and others in evaluating potential entries in the National Register.

Criteria for Evaluation

The quality of significance in American history, architecture, archeology, engineering and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and:

- a. that are associated with events that have made a significant contribution to the broad patterns of our history; or
- b. that are associated with the lives of persons significant in our past; or
- c. that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- d. that have yielded, or may be likely to yield, information important in prehistory or history.

Criteria considerations: Ordinarily cemeteries, birthplaces, or graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years shall not be considered eligible for the National Register. However, such properties will

Nominations to the National Register

quantity in any are integral parts of districts that do meet the criteria or if they fall within the following categories:

- a. a religious property deriving primary significance from architectural or artistic distinction or historical importance; or
- b. a building or structure removed from its original location but which is significant primarily for architectural value, or which is the surviving structure most importantly associated with a historic person or event; or
- c. a birthplace or grave of a historical figure of outstanding importance if there is no other appropriate site or building directly associated with his productive life; or
- d. a cemetery that derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; or
- e. a reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; or
- f. a property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own historical significance; or
- g. a property achieving significance within the past 50 years if it is of exceptional importance.

Information on documentation of properties and use of the Criteria for Evaluation may be obtained by writing: National Register of Historic Places, National Park Service, U.S. Department of the Interior, P.O. Box 37127, Washington, D.C. 20013-7127.



Winterport Historic District, Winterport, ME (Walter Smalling, Jr.).

State Nominations. State nominations are submitted to the National Park Service by State Historic Preservation Officers. Ordinarily, National Register forms to nominate properties are prepared by local citizens or by the staff of the State Historic Preservation Officer. These nomination forms are then submitted to a State review board, composed of professionals in the fields of American history, architectural history, architecture, prehistoric and historic archeology, and other related disciplines and may include citizen members. This review board makes a recommendation to the State Historic Preservation Officer either to approve the nomination if in the board's opinion it meets the National Register criteria or to disapprove the nomination if it does not.

During the time the proposed nomination is reviewed by the State Historic Preservation Officer, property owners and local authorities are notified. All property owners are given the opportunity to comment on the nomination and owners of private property are given an opportunity to concur in or object to the nomination. If the owner of a private property or the majority of such owners for a property or district with multiple owners object to the nomination, the State Historic Preservation Officer forwards the nomination to the National Park Service only for a determination about whether the property is eligible for listing. If a majority of owners do not object, a State Historic Preservation Officer may approve the nomination and forward it to the National Park Service to be considered for listing. If the nomination is approved by the National Park Service, the property is officially entered in the National Register.

Further information on the procedures to nominate properties to the National Register and the preservation program within your State may be obtained by contacting the appropriate State Historic Preservation Officer listed at the end of this leaflet.

Federal Nominations. Nominations to the National Register for Federal properties are submitted to the National Park Service through Federal Preservation Officers appointed by the agency heads. Federal agencies prepare National Register nominations, notify local officials and provide the State Historic Preservation Officer



Butler County Courthouse, Hamilton, OH (Pat Brown).

an opportunity to comment prior to submitting nominations to the National Park Service. The Federal Preservation Officer approves each nomination and forwards it to the National Park Service for final consideration. If the nomination is approved by the National Park Service, the property is officially entered in the National Register.

Information on Federal nominations to the National Register and other preservation programs of Federal agencies may be obtained from the Federal Preservation Officer for each agency. A list of Federal Preservation Officers is at the end of this leaflet.

Nominations by persons and local governments. The National Park Service may accept a nomination directly from any person or local government for inclusion of a property in the National Register if the property is located in a State where there is no State Historic Preservation Program approved by the National Park Service.

Appeals. Any person or local government may appeal to the National Park Service the nomination or listing of any historic property in the National Register. Appeals for nominations

may also be made to the National Park Service if a State or Federal agency fails or refuses to nominate a property. Procedures for appeals are found in the National Register regulations in 36 CFR 60.

Publications

A list of publications relating to the National Register is available from the National Park Service at the address given below. Information concerning National Register listings may be obtained from the National Park Service or from Federal and State Historic Preservation Officers.

Federal regulations for the National Register of Historic Places can be found in the Code of Federal Regulations under 36 CFR 60 (National Register nomination procedures), and 36 CFR 67 (certifications of significance and rehabilitation for Federal tax purposes).

Additional Information

For more information about the National Register, contact the National Park Service, U.S. Department of the Interior, PO Box 37127, Washington, D.C. 20013-7127, or any of the following National Park Service Regional Offices:

Alaska Regional Office
National Park Service
2525 Gambell Street
Anchorage, AK 99503

Mid-Atlantic Regional Office
National Park Service
600 Arch Street, Room 9414
Philadelphia, PA 19106

Southeast Regional Office
National Park Service
75 Spring Street, SW
Atlanta, GA 30303

Rocky Mountain Regional Office
National Park Service
12795 West Alameda Pkwy
Lakewood, CO 80228

Western Regional Office
National Park Service
450 Golden Gate Avenue
PO Box 36063
San Francisco, CA 94120

State Historic Preservation Officers and Federal Preservation Officers

State Historic Preservation Officers

Alabama: State Historic Preservation Officer, Alabama Historical Commission, 725 Monroe Street, Montgomery, AL 36130. Alaska: Chief, History and Archeology, Department of Natural Resources, Division of Parks and Outdoor Recreation, P.O. Box 7001, Anchorage, AK 99510. American Samoa: Territorial Historic Preservation Officer, Department of Parks and Recreation, American Samoa Government, P.O. Box 1268, Pago Pago, American Samoa 96798. Arizona: Chief, Office of Historic Preservation, Arizona State Parks, 800 W. Washington, Suite 415, Phoenix, AZ 85007. Arkansas: Director, Arkansas Historic Preservation Program, The Heritage Center, Suite 300, 225 East Markham, Little Rock, AR 72201. California: State Historic Preservation Officer, Office of Historic Preservation, Department of Parks and Recreation, P.O. Box 942896, Sacramento, CA 94286-0001. Colorado: President, Colorado Historical Society, Colorado Heritage Center, 1300 Broadway, Denver, CO 80203. Connecticut: Director, Connecticut Historical Commission, 59 South Prospect Street, Hartford, CT 06106. Delaware: Director, Division of Historical and Cultural Affairs, P.O. Box 1401, Hall of Records, Dover, DE 19903. District of Columbia: City Administrator—Deputy Mayor for Operations, 1350 Pennsylvania Avenue, NW, Room 507, Washington, DC 20004. Federated States of Micronesia: Historic Preservation Officer, Office of Administrative Services, Division of Archives and Historic Preservation, FSM National Government, Kolonia, Pohnpei 96841. Florida: Director, Division of Historical Resources, Department of State, The Capitol, Tallahassee, FL 32301-8020. Georgia: Commissioner, Department of Natural Resources, 1252 Floyd Towers East, 205 Butler Street, SE., Atlanta, GA 30334. Guam: Director, Department of Parks and Recreation, 480 Naval Hospital Road, Agaña Heights, Guam 96910. Hawaii: State Historic Preservation Officer, Department of Land and Natural Resources, P.O. Box 821, Honolulu, HI 96809. Idaho: Director, Idaho Historical Society, 610 North Julia Davis Drive, Boise, ID 83702. Illinois: Director, Illinois Historic Preservation Agency, Old State Capitol, Springfield, IL 62701. Indiana: Director, Department of Natural Resources, 608 State Office Building, Indianapolis, IN 46204. Iowa: Director, Iowa State Historical Department, Bureau of Historic Preservation, Capitol Complex, East 12th Street and Grand Avenue, Des Moines, IA 50319. Kansas: Executive Director, Kansas State Historical Society, 120 West 10th Street, Topeka, KS 66612. Kentucky: Director, Kentucky Heritage Council, Capitol Plaza Tower, 12th Floor, Frankfort, KY 40601. Louisiana: Assistant Secretary, Office of Cultural Development, P.O. Box 44247, Baton Rouge, LA 70804. Maine: Director, Maine Historic Preservation Commission, 55 Capitol, Station 85, Augusta, ME 04333. Republic of Marshall Islands: Historic Preservation Officer, Secretary of Interior and Outer Islands Affairs, P.O. Box 829, Majuro, Marshall Islands 96960. Maryland: Executive Director, Historical and Cultural Programs, Department of Housing and Community Development, 45 Calvert Street, Annapolis, MD 21012. Massachusetts: Executive Director, Massachusetts Historical Commission, 80 Boylston Street, Suite 310, Boston, MA 02116. Michigan: Director, Bureau of History, Department of State, 208 North Capitol Avenue, Lansing, MI 48918. Minnesota: Director, Minnesota Historical Society, 690 Cedar Street, St. Paul, MN 55101. Mississippi: Director, State of Mississippi Department of Archives and History, P.O. Box 571, Jackson, MS 39206. Missouri: Director, State Department of Natural Resources, P.O. Box 178, Jefferson City, MO 65102. Montana: State Historic Preservation Officer, Montana Historical Society, 225 North Roberts Street, Veterans Memorial Building, Helena, MT 59620. Nebraska: Director, The Nebraska State Historical Society, 1500 R Street, P.O. Box 82554, Lincoln, NE 68501. Nevada: Director, Department of Conservation and Natural Resources, Nye Building, Room 213, 201 South Fall Street, Carson City, NV 89710. New Hampshire: Director, Division of Historical Resources, P.O. Box 2043, Concord, NH 03302-2043. New Jersey: Commissioner, Department of Environmental Protection, CN 420, Trenton, NJ 08625. New Mexico: State Historic Preservation Officer, Historic Preservation Division, Office of Cultural Affairs, Villa Rivera, Room 101, 228 East Palace Avenue, Santa Fe, NM 87503. New York: Commissioner, Office of Parks, Recreation and Historic Preservation, Agency Building #1, Empire State Plaza, Albany, NY 12238. North Carolina: Director, Division of Archives and History, Department of Cultural Resources, 109 East Jones Street, Raleigh, NC 27811. North Dakota: State Historic Preservation Officer, North Dakota Historical Society, ND Heritage Center, Bismarck, ND 58505. Northern Mariana Islands: Historic Preservation Officer, Department of Community and Cultural Affairs, Commonwealth of the Northern Mariana Islands, Saipan, Mariana Islands 96960. Ohio: State Historic Preservation Officer, Historic Preservation Office, Ohio Historical Center, 1985 Valma Avenue, Columbus, OH 43211. Oklahoma: State Historic Preservation Officer, Oklahoma Historical Society, Wiley Post Historical Building, 2100 North Lincoln, Oklahoma City, OK 73106. Oregon: State Parks Superintendent, 525 Trade Street, SE., Salem, OR 97310. Palau: Chief, Division of Cultural Affairs, Bureau of Community Services, P.O. Box 100, Koror, Republic of Palau 96940. Pennsylvania: State Historic Preservation Officer, Pennsylvania Historical and Museum Commission, P.O. Box 1026, Harrisburg, Pennsylvania 17108-1028. Commonwealth of Puerto Rico: State

Historic Preservation Officer, La Fortaleza, P.O. Box 82, San Juan, PR 0091. Rhode Island: State Historic Preservation Officer, Historical Preservation Commission, Old State House, 150 Benefit Street, Providence, RI 02903. South Carolina: Director, Department of Archives and History, P.O. Box 11669, Capitol Square, Columbia, SC 29211. South Dakota: State Historic Preservation Officer, Historical Preservation Center, P.O. Box 417, Vermillion, SD 57069. Tennessee: State Historic Preservation Officer, Department of Conservation, 701 Broadway, Nashville, TN 37203. Texas: Executive Director, State Historic Preservation Office, Utah State Historical Society, 300 Rio Grande, Salt Lake City, UT 84101. Vermont: Director, Division for Historic Preservation, 5858 East State Street, Montpelier, VT 05602. Virginia: State Historic Preservation Officer, Division of Historic Landmarks, Department of Conservation and Historic Resources, 221 Govern Street, Richmond, VA 23219. Virgin Islands: Commissioner, Department of Planning and Natural Resources, P.O. Box 3098, Christiansted, St. Croix, V.I. 00820. Washington: State Historic Preservation Officer, Office of Archeology and Historic Preservation, 1111 West 21st Avenue, KL-11, Olympia, WA 98501. West Virginia: Commissioner, Department of Culture and History, Capitol Complex, Charleston, WV 25304. Wisconsin: Director, Historic Preservation Division, State Historical Society, 816 State Street, Madison, WI 53706. Wyoming: Director, Archives, Museums and Historical Department, Barrett Building, 2301 Central Avenue, Cheyenne, WY 82002.

Federal Preservation Officers

Director, Office of Rural Development Policy, Department of Agriculture Room 4141, South Building, 20250 Deputy Director for Program Development, Office of Administrative Services, Department of Commerce 20230 Director, Environmental Policy, Department of Defense, Office of the Assistant Secretary for Defense (Manpower, Reserve Affairs and Logistics) 20301 Assistant Secretary for Environment, Department of Energy, Room 4G084, Forrestal Building, 1000 Independence Ave. SW, 20585 Deputy Director, Office of Environmental Affairs, Department of Health and Human Services Room 5371 200 Independence Ave. SW, 20201 Assistant Secretary for Community Planning and Development, Department of Housing and Urban Development, Room 7100, 20410 Assistant Secretary for Fish and Wildlife and Parks, Department of the Interior 20240 Assistant Director, Cultural Resources Management, National Park Service, Department of the Interior 20240 Chief Policy and Planning Group, Facilities Management Section, Property, Management and Procurement Staff, Justice Management Division, Department of Justice 20530 Assistant Secretary of State for Administration, Department of State 20520 Office of Economics, Environmental Division, Department of Transportation, Room 10223, 20580 Assistant Director (Environmental Programs), Office of Administrative Programs, Department of the Treasury 20220

Independent Agencies

Environmental Protection Specialist, Office of Environmental Review (A-104), Environmental Protection Agency 20460 Federal Communications Commission, 20554 Director of Historic Preservation, General Services Administration 20405 Section of Energy and Environment, Interstate Commerce Commission 20423 Facilities Division, NASA Hq. (NXB-9) 20546 Chief Historic Preservation Branch, National Capital Planning Commission, 131 G St. NW 20576 U.S. Historian, National Science Foundation 20550 Small Business Administration, 1441 L St. NW 20418 Special Assistant to the Secretary, Smithsonian Institution 20560 Director, Office of Real Estate, U.S. Postal Service, 20260 Office of Construction, Veterans Administration, 811 Vermont Ave. NW 20420 Senior Staff Member for Historic Preservation, Urban Affairs and Land Use, Council on Environmental Quality, 722 Jackson Pl. NW 20006 Regional Environmental Economist, Regional Impact Analysis Section, Nuclear Regulatory Commission, 20555 Office of Natural Resources, Tennessee Valley Authority, 219 Locust Street Building Norris, TN 37902 International Boundary and Water Commission, U.S. Mexico, 4110 Rio Bravo, 200 IBWC Building, El Paso, TX 79902

* U.S. GOVERNMENT PRINTING OFFICE: 1988-0-221-617

Cover: Old Post Office, St. Louis, MO (Ariango Photos), Piedmont Choral Kites, Hilliard, western Wyoming (Jack F. Boucher, HABS), Cumbres and Toltec Steam Railroad, between Antonio, CO and Chama, NM (Ernest W. Roberts), Reed Smoot House, Provo, UT (George R. Adams), Frederick Historic District, Frederick, MD (Jel Lowe), Champo-Fremont I. Archeological Site, Omaha vicinity, NE (Nebraska State Historical Society).

